«This is THE 'Sound' Book of the Decade.»
Don Campbell
Author of *The Harmony of Health* and *The Mozart Effect*

Alexander Lauterwasser

Water Sound Images

The Creative Music of the Universe

Water Sound Images brings Dr. Hans Jenny's Cymatics into the 21st Century....Breath-taking images of sounds shaping water are supported by a text that encompasses both the scientific and spiritual....
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Music and Sound in the Healing Arts; The Polarity Therapy Workbook

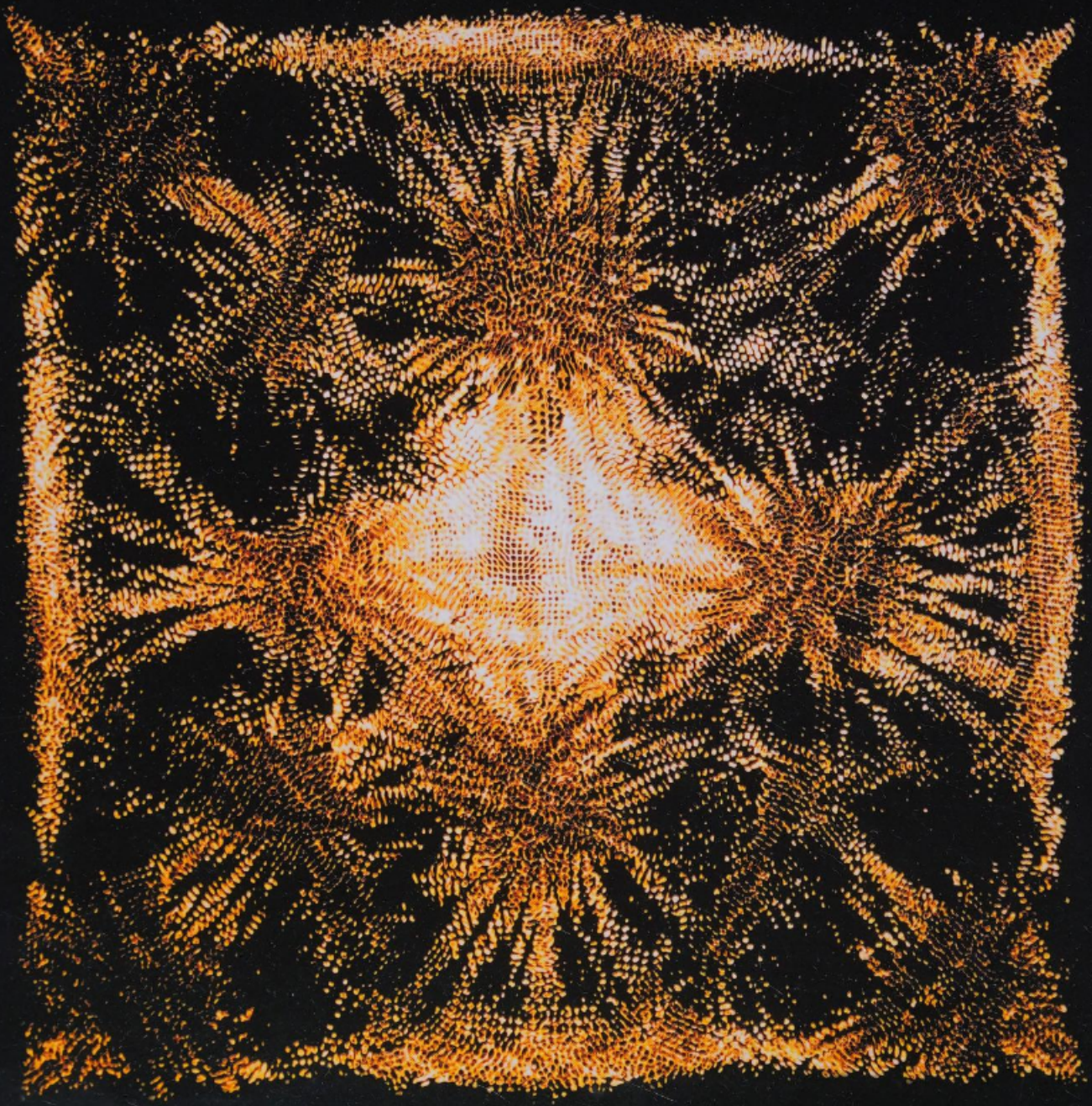
Water Sound Images is a revelation, a giant leap for art, eye and ear. Never before has the energy of great music and sound been so accurately portrayed, and with such stunning visual beauty, scholarliness, style and integrity.

This is the THE 'sound' book of the decade!"

Don Campbell
Author, The Harmony of Health and The Mozart Effect

....an important contribution to our understanding of the impact of sound on physical matter and, in particular, the impact of the complex patterns of sound waves on complex systems in motion [Complexity Science]. This book makes significant contributions to our understanding of the physics of chaos and of the potential of sound and music in medical treatment. This is a "must have" book for scientists, sound healers, and music therapists.

Professor Barbara J. Crowe, MT-BC
Director of Music Therapy, Arizona State University
Past President, National Association of Music Therapy
Author, Music and Soulmaking: Toward a New Theory of Music Therapy



Publisher's Note to the English Language Edition

I feel very privileged to present Alexander Lauterwasser's phenomenal work here, for the first time, to an English-speaking audience. Many painstaking hours have been spent going over this material in an effort to convey some rather esoteric and complicated concepts as accurately, and aesthetically, as humanly possible. The grammatical structure of German and English is quite different, and there are some cultural peculiarities that are not easily translated. I would like to thank harpist, Lisa Lynne, for introducing me to my translator for this project. With his background in physics, esoteric studies, as well as a wide range of literature and poetry, Gunter Zielke was clearly destined for this task! I am very grateful for his significant contribution to this effort.

As the author is painfully aware, having waited so long for the publication of this edition, I have spent copious hours checking and revising many successive translations, until, like a harmonic structure emerging from chaotic turbulence, this book has finally emerged in its present form. I took on the responsibility to interpret the author's writing (and the many selections he used for which we could not find suitable translations), and to present it in as clear and readable a manner as I could. It is unavoidable that some of the author's initial intentions may have been altered in the translation. For this, I sincerely apologize, and would urge all who are able, to consult the original German language edition.

What began as a publisher's duty has indeed become a labor of love. So it is with great satisfaction that I now release this newly transformed edition to the world. It is my hope that you will enjoy as many hours contemplating this remarkable work, as we have in making it accessible to you.

In resonance,

Jeff Volk, Publisher
Saco, Maine, July 4, 2006

The subtitle «The Creative Music of the Universe» is taken from the essay «Christianity or Europe» by Novalis. «And more—the religious hatred permeated naturally and logically to all aspects of expression, from heretical fantasy and emotion, to morality and art appreciation, future and past. It only barely positioned Man at the top of the evolution of natural beings, and made the infinite creative music of the universe into a clatter of an immense mill driven by and floating on the stream of chance, a mill of its own monotonous device, without master-builder or miller and in fact a *perpetuum mobile*, a mill milling itself.»

Cover photo front: Water-Sound-Image, 102.528 Hertz.
Cover photo back (from left to right): Humpback whale song, Water-Sound-Images, 1339 Hertz, 102.58 Hertz.

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Alexander Lauterwasser

WATER SOUND IMAGES

«The Creative Music of the Universe»

MACROmedia
Publishing
Enlightening the Questing Eye
Awakening the Discerning Ear

◂ Water-Sound-Image, 1330 Hertz.

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In memory of Walter Vox

«Here is one line of approach we can follow in our study of the origin of regular design in organic nature. We can plunge ever deeper in our observation of Nature and seek to read the riddle of its forms and processes. We can explore a specific periodic process and discover the rythmicity of its structural motif. What we want to do is, as it were, to learn to 'hear' the process that blossoms in flowers, to 'hear' embryology in its manifestations and to apprehend the inwardness of this process.»

(Hans Jenny, Cymatics II, 1972:-173)

Introduction

The naturalist Ernst F. F. Chladni (1756–1827) was both a contemporary and a compatriot of J.W. von Goethe, the great German, poet, philosopher and natural scientist. He performed a series of experiments using glass plates which had been covered with fine sand and then stroked with a violin bow. The friction of the bow against the edge of the plate made the glass 'sing' much like when you lightly glide a finger around the wet rim of a crystal glass. He discovered that particular patterns occurred depending upon the pitch of the vibration created by the action of the bow. These patterns came to be called Chladni sound figures.

The formative or generative power of sound has been recounted in ancient mythologies and creation stories from around the world, and addressed by many philosophers and natural scientists. But finally, through the discovery of Chladni sound figures, perhaps for the first time in history, this mythical power became a phenomenon that was directly accessible to our senses.

Major advances in this field of exploration were made in the 1960's and '70's by Swiss physician and natural scientist, Dr. Hans Jenny (1904–1972). He widened the field of study greatly by using different materials, such as powders, pastes, and, perhaps most interestingly, liquids. He made this form-giving power evident through a multitude of fascinating sound forms, many of which demonstrated the propagation of structural forms in three dimensions. He documented his extensive experiments in several short films, and in hundreds of photographs, many of which were compiled into two volumes published under the name 'Kymatik' (from the Greek *to kyma*—the wave), or 'Cymatics' in English.

Because of advances in technology over the intervening 150 years, Dr. Jenny was able to undertake and document these phenomena with much greater precision. He was able to examine the effects of specific frequencies on these different materials, and to duplicate the experimental conditions, and thus the patterns, at will.

As an extension of these works, I am most interested to further explore the specific vibrational phenomena already documented by Hans Jenny, and in particular, to show the step-by-step development of a phenomenology and typology of forms created by these vibrations. I also share Dr. Jenny's fascination in relating these patterns to the diverse processes of form and shape-building in nature, especially with regards to the morphogenesis of organisms.

In this endeavor, I have neither a preference solely for physical or natural-scientific facts, nor for exclusively aesthetic aspects. It is my concern to strive for an integration of science, philosophy and art with respect to unprejudiced viewing, lively thinking and deepened questioning. Therefore we will consider a great number of thoughts and various perspectives from these diverse areas.

It is my hope that as you ponder these fascinating images, in all their myriad layers and multifaceted richness, the integrity inherent in all of these subjects will become apparent to you. May this work serve to further inspire the thoughtful reader in their own deep contemplation and astounded gazing.

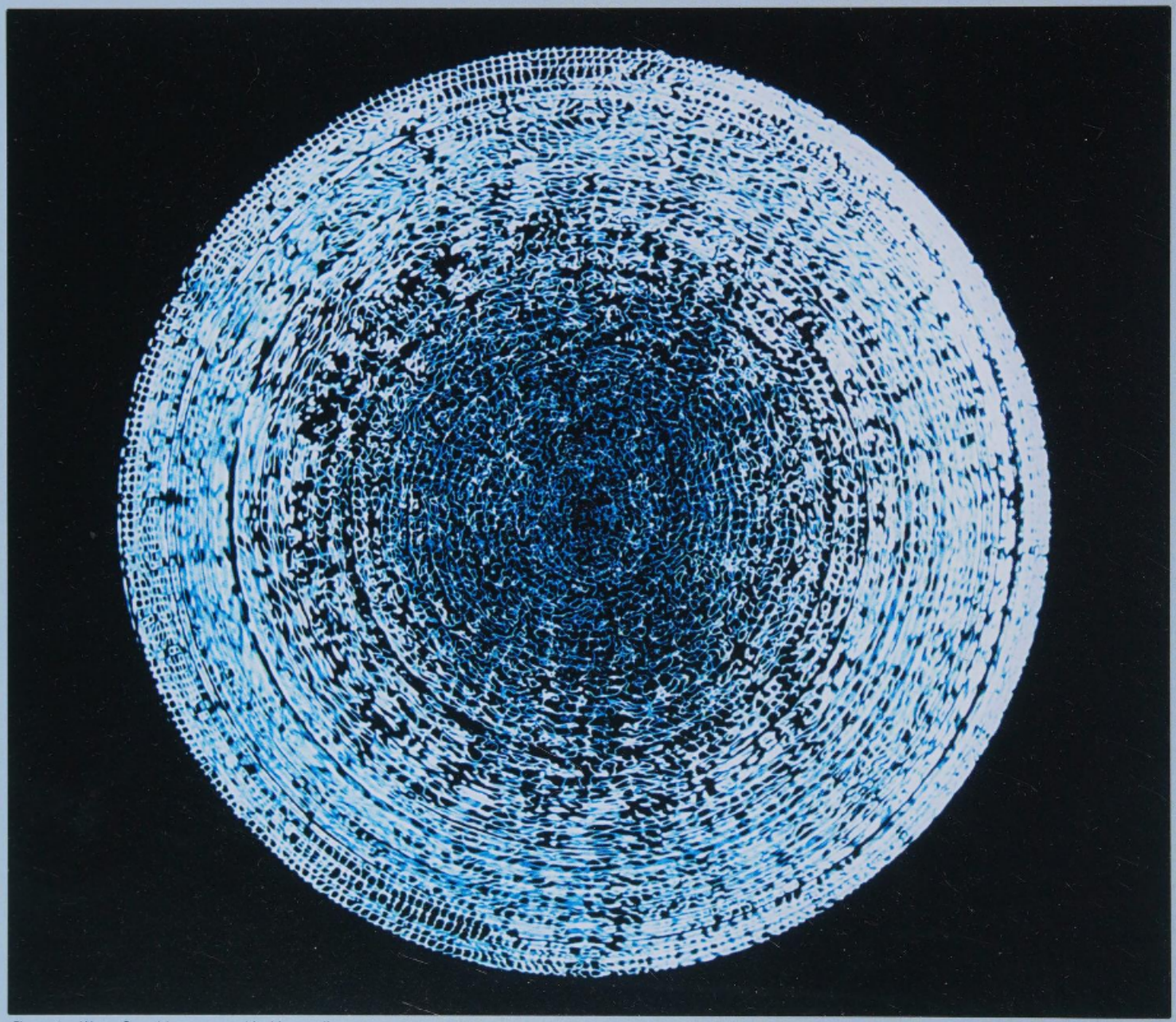


Figure 1 – Water-Sound-Image, sound inside a well.

COSMOGENESIS AND SOUND

MYTHOLOGICAL–PHILOSOPHICAL

«I did hear it from the writer's son;
the writer's son did hear it from the rhapsodist's grandson;
the rhapsodist's grandson did hear it from Clearview;
Clearview did hear it from the Hearken;
the Hearken did hear it from Tone;
Tone did hear it from Sound;
Sound did hear it from Secret;
Secret did hear it from the Void;
Void did hear it from Tao.»

(DSHUANG DSI, The True Book from the Southerly Blossom's Rim, 1974: 88)

Our materialistic thinking cannot conceive of the beginning of all being, before the birth of the cosmos; we are incapable of speaking about it. As Lao Tze said, we know that the «meaning that can be pronounced» is not the «eternal meaning» and the «name that can be called» is not the «eternal name» (LAO TZE 1976: 41). But still, through all times, man has never ceased to contemplate the unfathomable. As if he had an inkling that in questioning the essence of his own being and the meaning of the world, he would lose the only real possibility of an answer without reference to this basic ground of the world.

From the very beginning of our becoming conscious up to the present day, man has repeatedly encountered these secrets, filled with dark premonition and uncertainty. With fascination and reverence, again and again he has tried to describe it in mythological images and in expressions that transcend everything comprehensible in this world, sometimes stammering but then, in the face of its enormity, falling silent again. «No sage can be heard from these times, because these are times of stillness and silence. Only in speech, revealed by God, are there single shining flashes tearing this ancient darkness.» (SCHELLING 1985; 4:222)
«The One without which there is no Other» sounded the ancient hymn of the Vedas (Rigveda X, 129, quote VELTHEIM-OSTRAU 1951: 213); «*Ein-sof*» («no end») whispered the ancient Hebrews (SCHOLEM 1970: 21ff); of the «chaos» (the gaping abyss) sang Hesiod and Orpheus (quote HANSEN 1991: 121, 124); of the «abyss of the divinity» as a «mode without mode and as a being without being», as an «over-being being and an over-being void» we hear Meister Eckehart proclaim in medieval sermons (MEISTER ECKEHART 1969: 334f). Jakob Böhme spoke of the «great depth all around», and Schelling (SCHELLING 1975: 99) speaks about the «Non-Cause», about the «oldest being.» And while Hegel's thinking about the «non-unfolded totality» in the famous closing of his *Phenomenology of the Mind* culminates in his speech of the «Lifeless Forlorn(s)» (HEGEL 1952: 564), the language of modern astrophysics has reduced this multitude of approximations of the truly featureless «Secret Being» to an unostentatious «Singularity,» as the One-ness of all base-forces and elementary particles of our universe before the Big Bang (MITTON 1980: 380).

The question of 'Where-from' the World has been removed from us into the unreachable and unfathomable. The mysterious question remains the 'How' of the Beginning, the transition from 'Nothing' to 'Something,' and even more mysterious the question of the 'Why.' What was the power of manifestation that from the abyss of chaos brought about this artfully crafted miracle that the Greeks named 'cosmos' meaning order, and also jewel? Again and again sages and scholars suspected in this force a reality able to bridge the divide between time and eternity. Because this was experienced as a reality that was itself not torn by the dividing/separating origin, it was able, on one hand, to reach down into the dark formless abyss, and on the other, to be simultaneously experienced in this world. This reality was seen as integral to the creation of the universe and thus in all processes of manifestation, permeating space and objects with primal and subtle force. This reality that is able to touch, seize and move souls, nevertheless veils itself in formlessness and thus withdraws itself from any substantiation. This acting reality is the Sound.

Without purporting here to develop a conclusive theory of the origin of the cosmos, a cosmogony, the central aspects of the development of the universe, caused by vibrations, tones, and sounds, shall be presented as

Figure 2 – Vishnu and his wife on the giant serpent *Ananta*, «Endless», as an image of the un-enfolded cosmos. (India, about 1760, from PURCE 1988.)

«On the serpents-ocean of his own immortal substance the Master of the Cosmos spends the night of the universe.» (ZIMMER 1972: 45)

a demonstration of the various images and motifs of mythology and philosophy by building on the groundbreaking works of Marius SCHNEIDER (1951ff.) and Hans-Georg NICKLAUS (1994). The different elements herein are not necessarily to be understood as a time sequence, but more as different aspects of universal events.

A hymn of the ancient Indian *Rigveda* sings about this primordial cause:

«The Origin Of Things

When there was neither non-being nor being,
No atmosphere, nor heaven above —
Who guarded the world, who embraced it?
Where was the abyss, where the sea?

Neither death was then nor immortality,
Not was the night, invisible the day.
The windless breath in primordiality
Of the One, without Whom there is no Other.

With dark all world was covered,
An ocean without light, forlorn in the night;
Then, long hidden in its shell,
The One was born, by the power of blazing heat.»

(quote VELTHEIM-OSTRAU 1951: 213)

Here we are told how an eternal force rests in hibernation in an abyss of darkness, emptiness, and motionlessness. That it initially breathes «windless», almost motionless, attests to its still hidden aliveness, completely lost in itself. At some point, the still quiet whiff and breath begins to stir as we learn from *Genesis* of Moses, in which the Spirit of God moved upon the face of the water. The Hebrew word used here, *ruach*, means to waft but also «breath», «life», «soul», «spirit» (NICKLAUS 1994: 54). The similarity of the German word *Atem* (breath) and the ancient Hindustani word *atman* as the epitome of «spirit, soul» should also be noted. (cmp. BERENDT 1986: 40) All these are images and ciphers of still «inaudible primordial sounds at the beginning of the universe» wherein the breath as the «silent predecessor of the collective meaning of the words» announces itself.

A further element of these events of the creation of the universe, is an increasing contraction and condensing, developing gradually into warmth and then scorching heat, which then gives birth to the seed as the «Only»

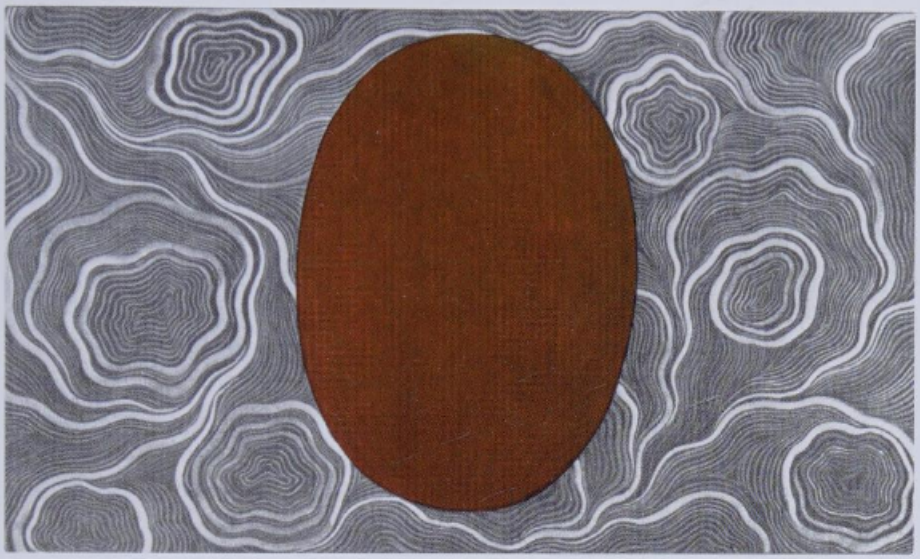


Figure 3 – The World's Egg: A picture of primordial space, swimming in the cosmic ether-ocean (India, c. 1775, From PURCE 1988)

«Thus in the beginning this (universe) was water, nothing but flood. These (waters) wished: how can we propagate? They struggled, they heated inwardly. Out of this inward heating emerged a golden egg. The year was not yet born then. The golden egg swam about ... from it arose ... a Man, Prajapati ... He broke the golden egg. Still there was no firm foundation... After one year passed he tried to speak. He spoke *bhuh*, thus became this earth. He spoke *bhuvah*, thus became this sky. He spoke *svah*, thus became yonder heaven.»

(GLASENAP 1926:86)

or «First» also seen as the «Golden Egg» to which the Indian Brahmans refer (GLASENAPP 1926: 86). This should be a hint of the cosmogonetically important step of the emergence of this primordial space, which appears in images of opening lips and the mouth. «When Ataman spawned the world... his mouth split like an egg» (SCHNEIDER 1951: 116); or: «before Brahma, the first-born of the universe, was created as a god, he was born as a mouth» (NICKLAUS 1994: 182). Marius SCHNEIDER adds: «The central idea of a purely acoustic period often appears under the image of the egg, the cave, the head, or the opened mouth, which all point to an unlimited sounding board in which an 'unspecified desire lives' and out of which evolves the Word of creation.»

«The highest being, resting in water's form, drew together in its own glowing energy. Then, in its limitless force, it decided to bring forth again the universe. He, who himself is the universe, imagined the universe with its five elements Ether, Air, Fire, Water and Earth. Unfathomable silence lay across the ocean. After Vishnu had immersed himself into the water he moved it quietly. Waves rippled and as they followed each other, a small gap formed between them. This gap was the Ether, the most delicate of the five elements, the carrier of the invisible, intangible quality of the tone. The space resounded and from the tone arose the second element, the air, in the form of wind.»
(ZIMMER 1962: 70)

This process of primal development of space has been conceived and depicted in the kabalistic tradition under the Hebrew word *zimum*, which can be translated as «contraction» (SCHOLEM 1970: 85ff). However, if one understands this «contraction» not simply as a concentration into its own center, but rather as a withdrawing oneself into an enclosing sphere, then this opens an inwardly free space, in which creation can occur. Is this act not comparable to the vacuum within the suction-creating, expanding chest during the first breath at birth?—Who knows which primordial gestures and movements living beings are imitating, and perhaps if ultimately, the key to an 'inward' understanding of the world lies hidden in a living organism?

«Only where God withdraws 'from himself into himself,' can he cause something which is not divine essence and divine being itself» (SCHOLEM

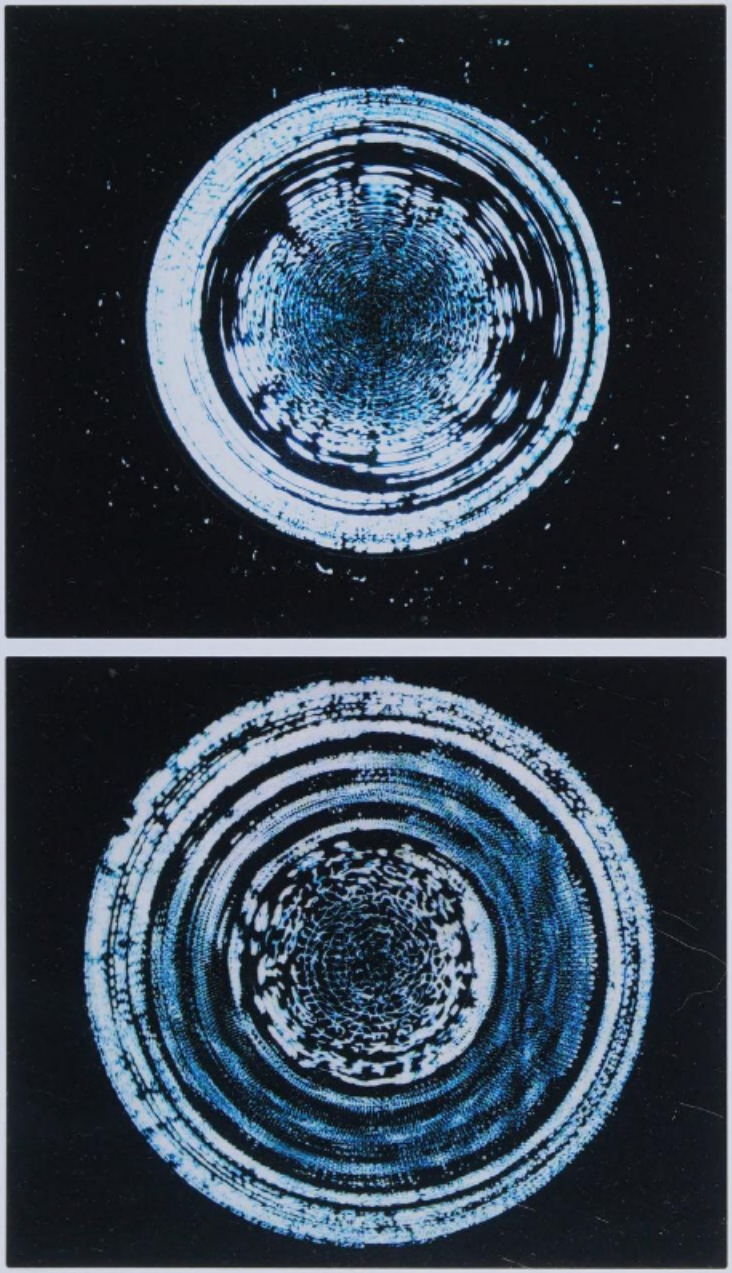


Figure 4 – Water-Sound-Image, sound of a well.

1970: 85), something different: the creation. «There is thus an act, in which God withdraws minutely from himself, even if it is only from a single point of his essence. Such 'point' in a divine sense, referring to this act, would be the true mystical primordial space of all creation and of all processes of the world» (prev.). Could Rainer Maria Rilke's word-creation of «world-inner-space» (RILKE 1976a: 87) be construed as an echo of this first ovum of the cosmos?

An essential aspect of the secret of sound is touched with the formation of this primordial space as an «infinite sounding board» (M. SCHNEIDER). Light requires the outwardly oriented surface of objects from which to reflect, and only thus becomes visible to the eye. Yet at the same time it is inhibited, hampered and limited by the surface of this object. Whereas the phenomenon of sound is inseparable from the inner surface's liberating cavities, only within which the power of tones can fully unfold.

In many myths of the world 'water' appears as the central theme of the genesis of creation; nevertheless it is not to be equated with today's element 'water.' The liquid primordial ocean is not something 'arisen,' but the expression of pure becoming and 'forming,' a flowing, streaming medium, of the archetypal, embryonic world-seed as living, pulsating vibration (NICKLAUS 1994: 21ff; cp. SCHNEIDER 1966: 70).

«Water» means wave, oscillation; «Primordial Ocean» means Sea of Sound, flowing, vibrant abundance filled with possibilities for formation, rushing, roaring, booming, starting to whisper. «With this primacy of the Sound in the history of creation, it is crucial that the so-called primordial waters are not true water but have to be understood as the rhythm of sound waves of the Word. The sound of rushing water is older than water, volcanic humming is older than fire» (SCHNEIDER, quote after NICKLAUS 1994:64), and so it says in the ancient Vedas:

«*Aksara-Brahman, Brahma* in the shapeless realm of pure thought, shows himself for the first time as a golden embryo of sound. He was a tone, oscillating in and out of the void and returning unto himself. When the sound waves crossed, so emerged water and wind, beginning to weave

the fog-like body of the world while playing upon each other.» (NICKLAUS 1994:22)

Sounds, tones, notes—penetrate primordial space, vibrating. According to some myths, the dawning of light started here—the «aurora of creation» (SCHNEIDER 1966: 61ff.). It is said that the outburst of light, splitting the darkness, the birth of day, was accompanied by a scream, the first becoming of a voice (GEORGIADES 1958: 9ff.; SCHNEIDER 1978: 15, 1952:22). Marius Schneider, speaking about «lucent sounds», about «light-sound» (SCHNEIDER 1951: 118), tells about a song which man sang to greet the rising sun. «The one glowing there, she shall be revered as a burning melody. Let us praise the sun, because she sings about the marvels she heard during the night» (SCHNEIDER 1979: 30). In the *Rigveda* (quote after NICKLAUS 1994: 194) it is sung: «The sun radiates through a canticle born out of truth.»

Within the vibrating sound, the momentum of the all-pervasive, vitalizing, creatively welling forces and energies takes effect. We find within the light, flashing up and brilliantly streaming through space, more the momentum of the forces ordering space, spreading out and creating distance, so that the clearly articulated Word starts to form, being spoken through accentuating, chanting and the rhythmicity of the vibrating stream of sounds and tones. Words appear as «illuminated sounds.» The rhythm-in-flowing as the light in sound, the «fire in water» as the meaning in the word (NICKLAUS 1994: 136, 179, 189). The Greeks called it *Logos* and meant the synchronicity of 'mind' and 'speech,' the sounding Word as announcement of the mind.

«In the beginning was the Word,» as symbolically depicted in this image from a German bible of the late Middle Ages, portraying the creation of the world (Figure 8, Page 16). Out of the spherical ambit from God's mouth emanates the sound of the spoken word, which as light, shines into the primordial space, then condenses through oceanic and ever more dense matter, streaming into the middle until it crystallizes as earth. What a profound image we see of the cooperation of sound and light in a resounding universe: powerful and warm, the breath of air gushes from within the chest, raised to sounding voice by the larynx, molded to a clear sound by a thought, so that the idea becomes a voice and meaning reveals itself taking shape as speech. In the Old Testament it is 'God's Spirit,' the 'whiff of air' that wafts across the chaos, the 'primordial soup,' or as Martin Buber

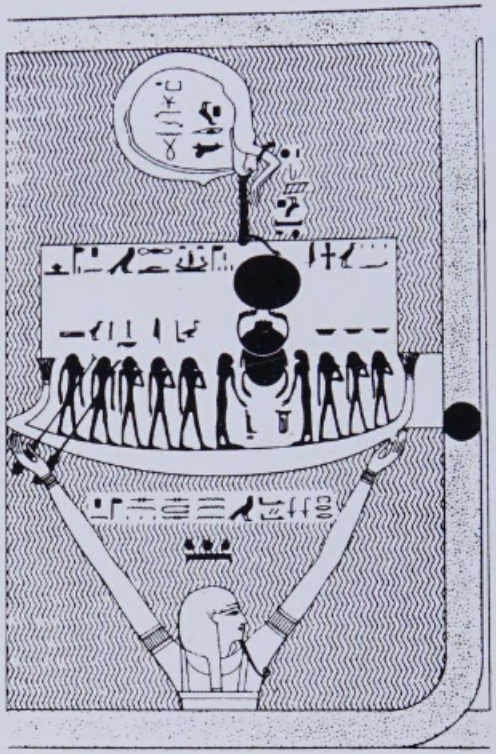
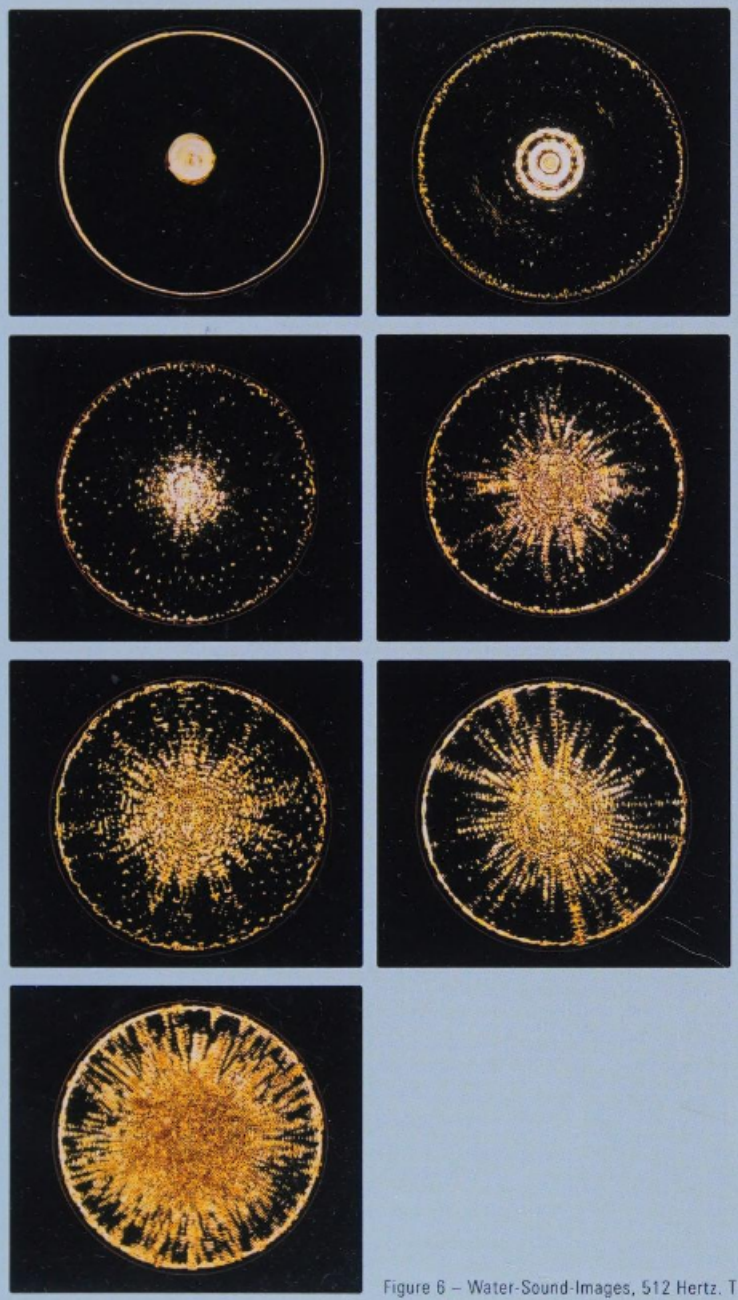


Figure 5 – End-Image from the ancient Egyptian «Book of Portals» (from HORNUNG 1991)

The rising of the sun, repeated each morning, and seen as an image of the sun's rebirth, occurs as an archetype of the primordial processes of the creation of the world. From the depth of the primordial waters arisen by the god Nun, held by Scarab as the power of change and resurrection, received by heaven's goddess Nut, the light of the young sun begins to radiate—amidst the primordial space, the «World-Inner-Space» (RILKE), engulfed and at the same time liberated by the waves of the primordial ocean. (after HORNUNG 1991: 198)



«In the beginning there was only the vast and quiet, endless, world ocean. It was very silent and without life. There was still no Up and Down, no Front and Back. There was neither East nor West, neither North nor South. Bright and Dark were not yet divided, nor had the Light and Darkness yet emerged.

The Ptah stepped into the void. He wore the form of Nun and Naunet, the primordial waters. And of Huh and Hauhet, the 'Grand Infinitude.' In those Ptah appeared. Just as he appeared in the form of Kuk and Kauket, the 'Eternal Darkness,' and he took the form of Niau and Niaut, the 'Great Negation.' Ptah also appeared as Atum.

These gods, in their nine-fold manifestation, were teeth and lips in his mouth, out of which emerged Schu and Tefnut. Thus had Ptah devised them: the seeing eyes, the hearing ears, the breathing nostrils, reporting everything to the heart.

Ptah had devised the whole world in his heart, before all, he contrived the gods and so consummated the Nine-ness. Everything he devised and contrived, his tongue spoke as a command. And thus it was.»

(Ancient Egyptian myth of the creation of the world, after HANSEN 1991: 23)

Figure 6 – Water-Sound-Images, 512 Hertz. The pattern becomes increasingly complex as the amplitude (volume) increases.

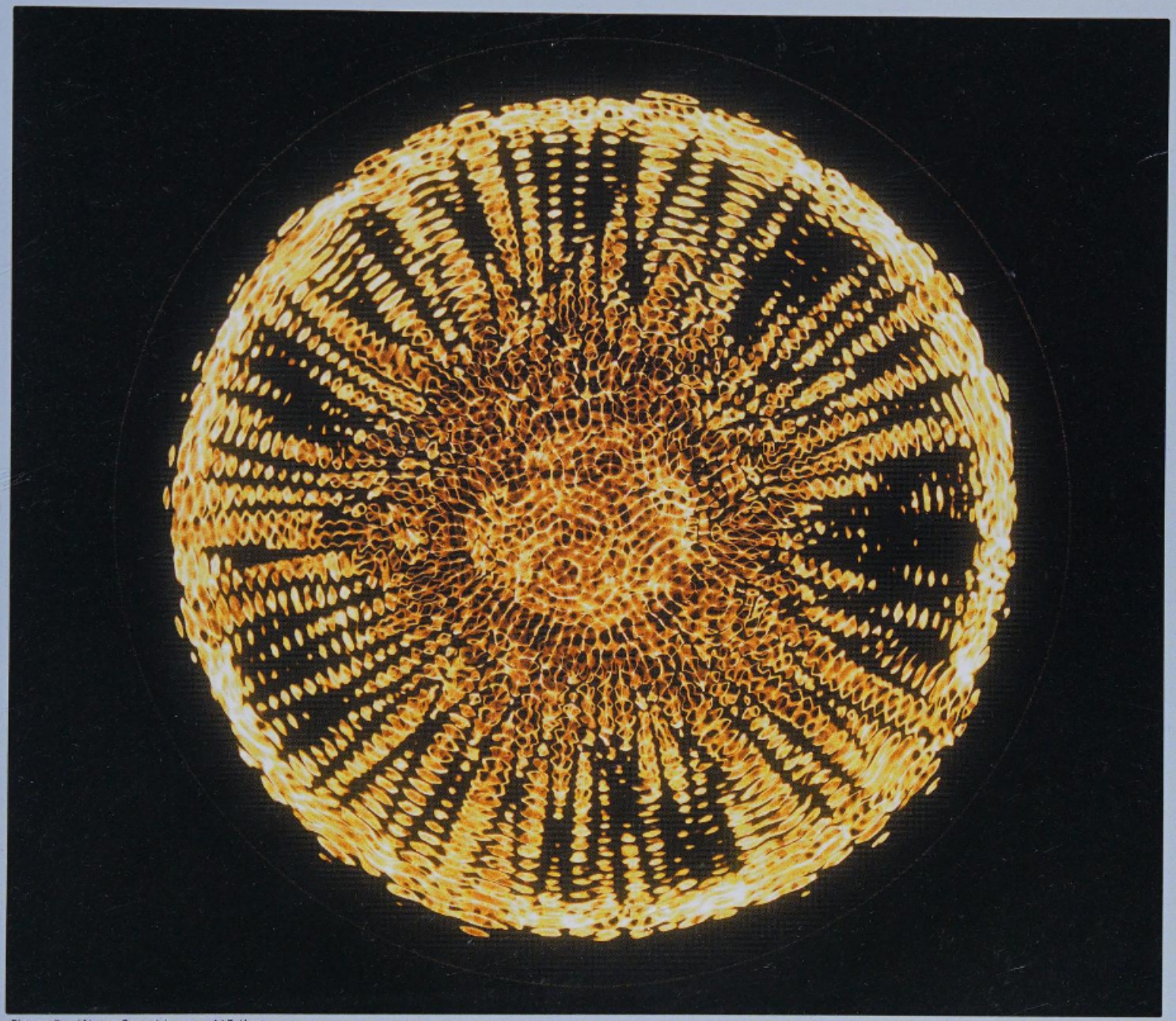


Figure 7 – Water-Sound-Image, 417 Hertz.

Figure 8 – The Creation, Colored Woodcut, German Bible, Nürnberg, 1483
(Leopold-Sophien Library, Überlingen)

more elegantly translates it «God's rushing roar pulsating above the water's countenance.» (BUBER/ROSENZWEIG 1997). Through this «and God spoke,» meaning by the hush and sound of his words, of his «light-voice» (NICKLAUS 1994:60, SCHNEIDER 1990: 43, 48) does God bestow form and shape to the depth: «reassuring and at the same time giving oath with every word, by which the One became All» as described by Schelling (quote after HOGREBE 1989: 105).

In the cooperation of vibrating sound and shining light, of primal forces and primordial images—the development of the cosmos takes place in a step-by-step process of transition from an amorphous, totally fluid state which scarcely suggests any sense of order or design—graduallly emerging into a clearly shaped, solid form of existence, in which life-forms increasingly complexify and differentiate from one another.

Rushing wind-breath, flowing sounds, vibrating tones, resonant voices resounding words within their swirling up and down through infinite pitches—sounds and rhythms create melodies, choruses. In the intervals and hidden harmonies of this spherical music, is revealed the inner structure of the «World-Soul» (cp. Plato, TIMAEUS) to one who is truly able to hear and listen judiciously (SCHNEIDER 1980: 95ff., SCHAVERNOCH 1981). Novalis called it, «the endlessly creative music of the universe» (NOVALIS, 1968: 398)

«Music is the body of the invisible.» (SCHNEIDER 1966, 68)

Wherever liquid substance, especially water, is agitated by an impulse, distinctly flowing 'sub-streams' or currents develop within, and waves form on its surface—this caused by its high receptivity and «impressionability» (SCHWENK, 1962: 26). Together these phenomena have to be considered the basis of all formative processes. Contrary to the world of solid borders and bodies, in which no 'something' tolerates a different 'something,' the still-liquid world enables a mutual penetration and overlay of very different motion-impulses. From their weaving patterns and structures, complex and more highly organized forms can evolve, which then take lasting shape by a gradual coagulation, solidifying and crystallizing.

«Should not all form-creation, from the crystal to the human, be explainable by acoustics, as retarded movement? A chemical acoustics ... all matter, sculpted by, and nothing less than a formation of music. (NOVALIS 1968: 497)

Marius SCHNEIDER (1978: 15) writes about this forming of the world through the word and the sound, «that in the old cosmogony this generative sound conforms to the expression 'expansion of the word' and is rooted in this singing force, which created the world as the first manifestation of a thought, that the sound of the primordial vibration sacrificed itself to progressively spread in a spiraling, growing rhythm of higher and higher and

newly spawned vibrations, gradually transmuted into stone and flesh.» In this same vein we read in SCHELLING, that «in most philosophical and religious systems, especially those of the East, the sole and absolute act of self-affirmation in God—the act of His eternal creating—was denoted as the speaking (Word) of God, the Logos, which is, simultaneously, God itself... so that also the whole of the real world ... is again a primordial speaking. But the world of the senses is no longer the living Word, the speaking of God himself, but only the spoken—coagulated—word» (quote after NICKLAUS 1994: 175). The visible, material world would be, by its very nature, «coagulated sound» and «frozen light», as Jakob Böhme holds, and so it appears with the end of «the tonal pulsation ... at least as a threshold—a dead body.» (NICKLAUS 1994: 47) Dead, because in the primal pictographic, vital «Double-Movement» (GOETHE) the momentum of the far-reaching and self-exceeding expansion, as well as self-reference, flagged and eventually disappeared, in favor of the condensing, closing-in-upon itself, resting momentum, thus becoming solidified and subject to gravity and inertia, and thereby petrifiying.

«As now all things of this evolve from the progressive materialization of specific sounds, so are they all symbols of their nature, meaning equivalent to their tones, within their respective realm ....» The whole world is gradually congealing music, a sum of vibrations, whose frequency increases to the degree that it materializes,» asserts Marius SCHNEIDER (1966: 128).

If all form and shape is coagulated music, aged gestures of liquid sound, is not then the whole world like an echo of these primordial sounds. Would not all shapes and bodies of nature actually be, in the deepest sense, resonance-bodies, each one permeated and tuned to a special moment of these sounds, a note, an interval, a tone, a word, a cadence, a melody?

«There Slumbers a song in all things,
Dreaming on and on,
And the world set out to sing,
If only you strike the magic word.»
(Joseph von EICHENDORF, quote after OBERKOGLER 1987: 11)

Perhaps we can now gain greater insight into the mythic motifs of ancient legends where it was told that within everything there rests a hidden name, a secret word, a sound that wants to be searched out, yearning to be awakened and revivified. As each individual entity refers to that to which it is attuned through resonance, to which it has a calling, and in which therefore lies its destiny—only then can it reach an agreement, a harmony with the whole, and finally, free of discord, may it strike the right note and play in tune with the symphony of life and the universe.

«The world is being created, and yet, this creature partially creates itself, insofar as she can perceive that which has been created for her in advance (the pre-configured) and obeys it. This hearing and obeying forms the response of the creature to the Word of creation. Man is that to which he listens, and as such he selects from what he hears and this selection determines his character and his fate.» (SCHNEIDER 1966: 48)

«The heavens tell of God's praise, and the celebrations announce the work of his hands. One day tells it to the next, and one night proclaims it to the other—without speech without word, with silent voice. Their sounding goes through all the lands, their speaking to the ends of the earth.» (Old Testament, Psalm 19)

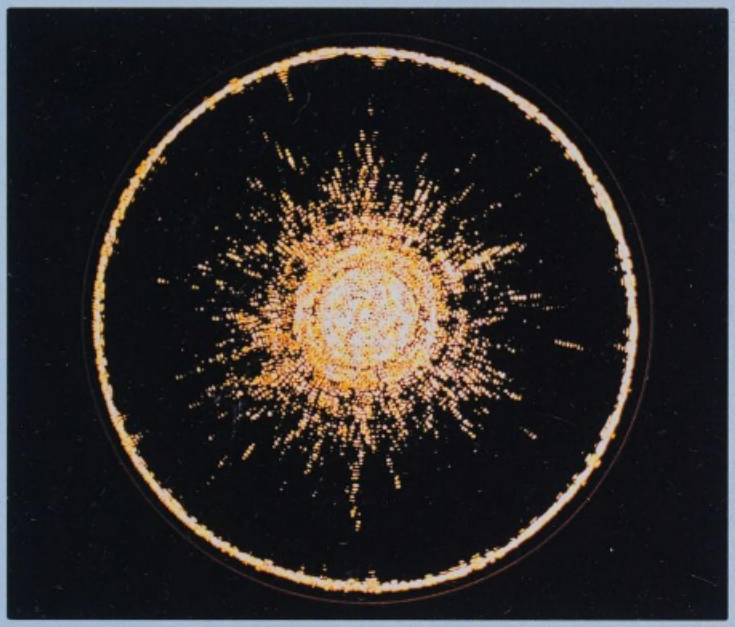


Figure 9 – Water-Sound-Image, 518 Hertz.

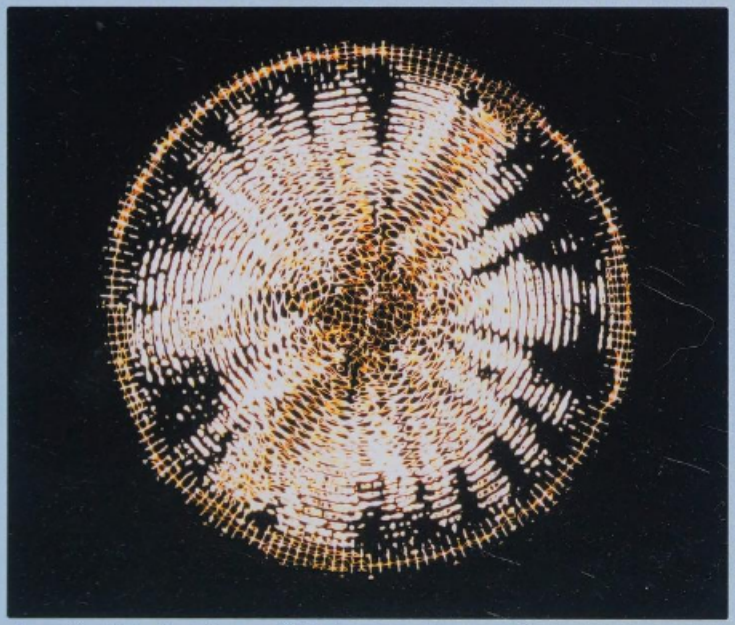


Figure 10 – Water-Sound-Image, 128 Hertz.

«The sheik of the order of Khalvati in Istanbul, Sünbül Efendi, looked for a successor. He sent out his disciples to bring flowers to adorn the monastery. All returned with great bouquets of the most beautiful flowers, only one, Merkez Efendi, brought a small wilted flower. Asked if he did not find anything worthy of his master he answered: 'I saw that the flowers were engaged praising God. How could I disturb them? Only one had just finished its contemplating of God, and this is the one I brought.' It was he who became Sünbül Efendi's successor.»

(Sufi-legend, after SCHIMMEL 1995: 77)

«We are only mouth. Who sings the distant heart,
Resting well amidst all things?
His big beat is divided within us,
Into small beats. And his great pain
Is, as is his great jubilation, too great for us.
Thus we tear ourselves away again and again
Being only mouth. But all of the sudden
The great heartbeat intrudes into us secretly,
So that we scream—
And are then Being, Change and Face.»
(RILKE 1976a: 136)

«Chorus is existence (being there, who does not sing,
has not yet arrived, will come).»
(RILKE/ZWETAJEWA 1998: 57)

May perhaps this all-pervasive tuning and attuning of each with the other reach an even deeper dimension? If all forms and shapes of nature are to be regarded as analogous to tones and sounds, then should of all things, consciousness, the most sensitive phenomenon of the cosmos, be any exception? Is not consciousness in fact the resonance-organ, the medium of response par excellence? As H.-G. NICKLAUS (1994: 105) characterizes it, «Everything created has the state of resonance of the creative Sound: as a body it is the resonance-body, as a mind with the ability to know, it is the echo of this creative Sound».

«Here, amongst the waning, be, in this realm of decline,
be a sounding glass, shattering itself heretofore in its sound.
Be—and be aware the same, of the conditions of not-being,
the infinite reason of your deep-rooted vibration,
that you perform it to the fullest, this one time.»

(Rainer Maria RILKE, Sonette to Orpheus, 1974: 78)

«Echo of heaven, holy heart! Why,
Why are you becalmed amongst the living,
Why sleep free spirit—you, from the Godless
Eternally expelled down into the night?

Guards no more as yore the ether's light?
And blossoms not Old Mother Earth?
And does not recite the spirit here and there,
The love without a smile, justice still yet?

Only YOU no more!?...»

(Friedrich HÖLDERLIN, Enlivenment, year unknown: 123)

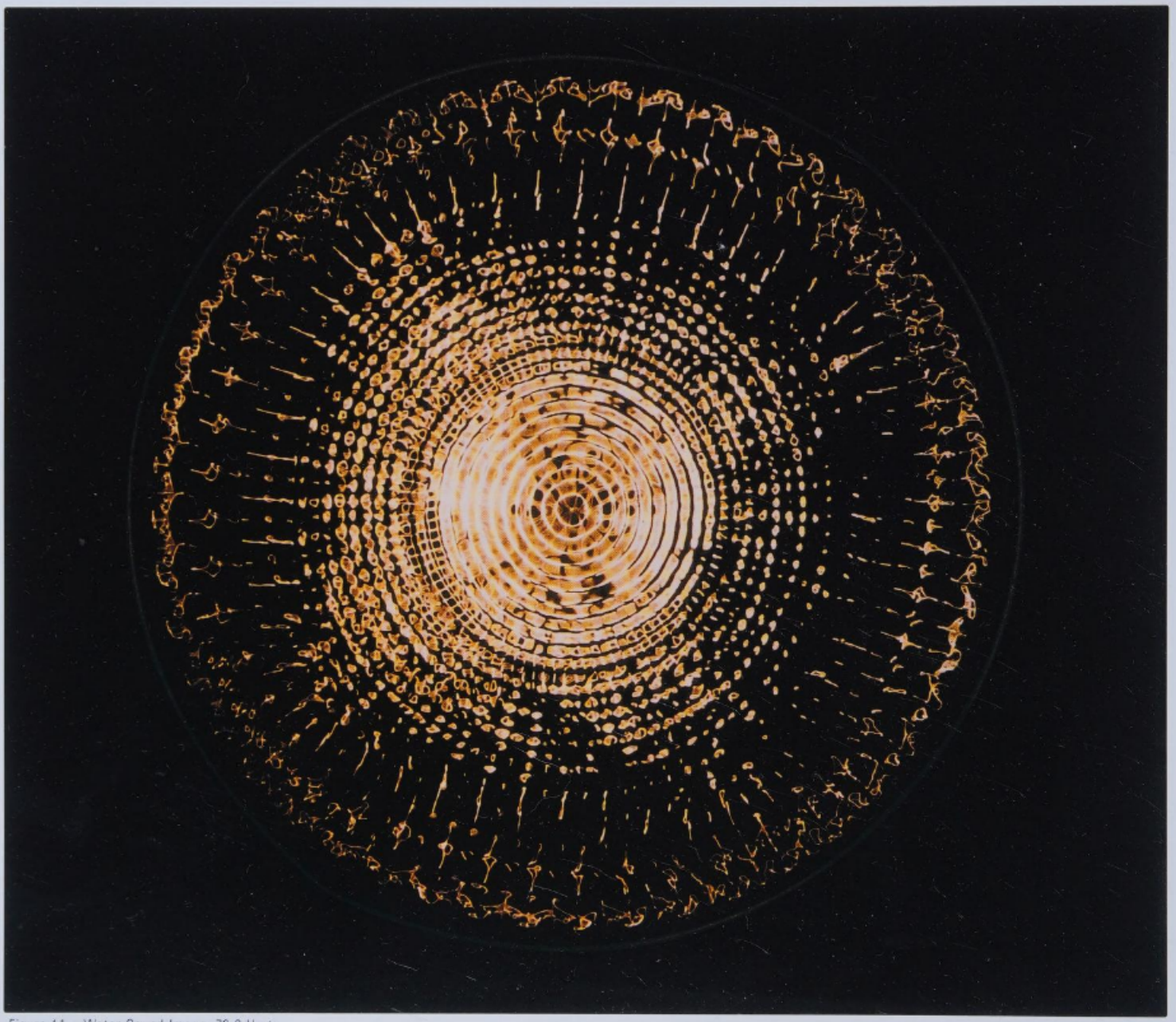


Figure 11 – Water-Sound-Image, 76.8 Hertz.

With such surprising precision, dependability, clarity and intensity, and with a safety bordering the primordial intimacy of sleep-walking, our senses bring us closer to their respective aspects of the outer world, anchor us in it, and downright give it to us as a gift—and this despite all their inate limitations and faultiness. Thus, in scarcely any current textbook on the psychology of the senses is the term 'resonance' omitted. Considering how much we actually 'know' about our environment, in as much as we have already been, in some sense, 'outside' before any cogitation starts to question the 'outside,' and to somehow even consciously 'know' it—doesn't it stand to reason, to also grant to this same consciousness, in its highest developed ability, the possibility of *re-sonance*, of tuning, of *attuned* thinking? (cp. HOGREBE 1989: 127)

«Playful clouds—game of nature exceedingly poetic.
Nature as an aeolian harp—
She is a musical instrument—
Whose notes once again
Are keys of higher strings within us. (Association of Ideas).»
(NOVALIS 1957, II: 126f.)

Indeed, the attribute which our consciousness must develop to enable this process to become an event, is the attention, which Malebranche once called the «natural prayer of the soul.» (quote BLOCH 1972: 41) HEGEL (ibid) phrases it: The attention «requires an effort, as man, wanting to grasp this one single thing, has to prescind from all the things moving in his head, from all his other interests, even from his own person, and has to have the matter operate by itself. The attention thus contains the negation of one's own self-importance and the giving over of oneself to the subject.»

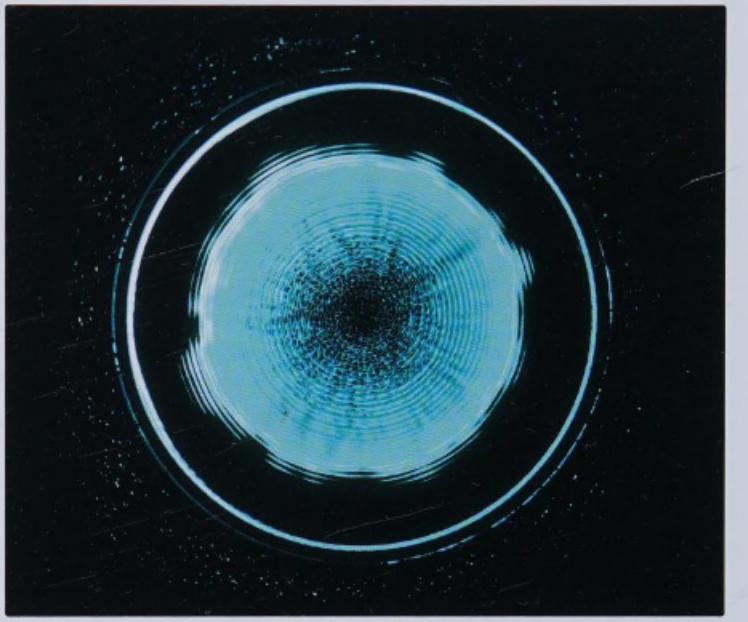


Figure 12 – Water-Sound-Image, Aeolean Harp (wind harp).

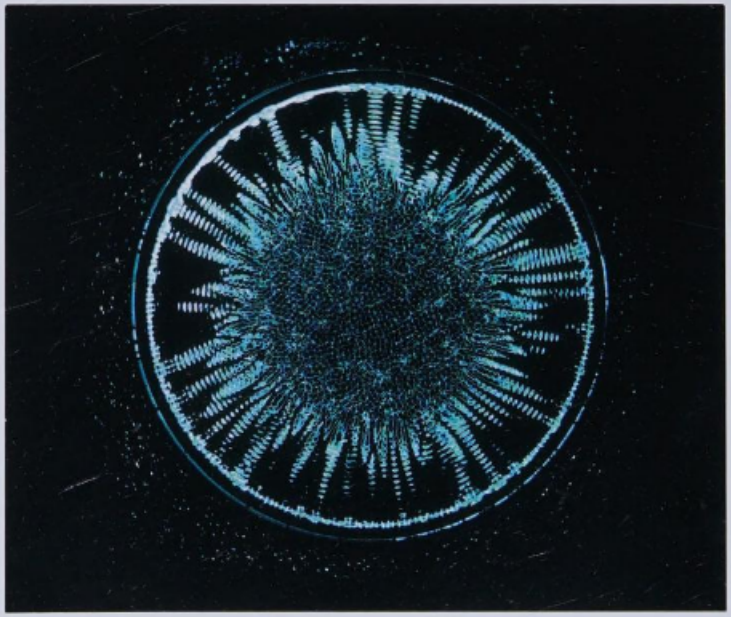


Figure 13 – Water-Sound-Image, Aeolean Harp (wind harp).

«O Nature! O soul of man! How far beyond all utterance is your likeliness! Not the smallest atom stirs
or lives in matter, but has its cunning duplicate in mind.»

(Hermann MELVILLE, Moby Dick, 1977: 318)

«The one space reaches through all beings: World-Inner-Space. The birds still fly Through us. O, the one who wants to grow, I look outside, and within me the tree is growing.»

(Rainer Maria RILKE, Abandoned in the mountains of the heart, 1976a: 78)

Figure 14 – Water-Sound-Image, 1034 Hertz.

Everything not belonging to the subject must be excluded to reach the culmination of inner meeting—everything not opening itself to the respective content, the non-accessible, meaning everything that does not want to attune itself and does not want to be touched or moved, everything that thereby disturbs the pure tuning. It must have «the subject work within itself,» «set the pace,» create its own effect and it must be able to let itself be spoken. Martin Buber once expressed such an an effort toward attunement with the following words: «and a being shapes around your direction, a tree, so that you may experience its unity, *the* unity. Already it is planted from the soil of the earth into earth of the soul, already it speaks his secretiveness into your heart, already you become aware of the mysteries of reality» (BUBER 1919: 15).

«Poems can not be invented

they exist without us somewhere since

somewhere behind they are there in eternity

the poet finds the poem»

(Jan SKACEL, Miracle Clover, quote KUNDERA 1983: 44)

Maybe it is a sign of successful attunement and accomplished inner resonance—when we have a 'notion,' when we 'have an idea,' or if 'something dawns on me'—just when I first succeed to be 'all ears' in 'effortless openness' (J. GEBSER), to be fully present and ready to be spoken to, to be touched and to be moved.

«As long as you catch what you yourself threw, everything is
skill and fleeting gain—
only when you suddenly become the catcher of the ball,
which an eternal teammate
threw at you in your midst, in an exact
skilled swing, in one of those arches
of God's great bridge-constructions:
only then does the ability to catch become a fortune—
not yours, but that of a world ...» (RILKE 1976a: 124)

«But», writes Novalis, «the artistry of calm contemplation, of the creative observation of the world is difficult, its execution requires ceaseless thinking and stern soberness, and the reward will not be the applause of ones lazy contemporaries, but only a joy of knowing and watching, an inner touch of the universe» (NOVALIS 1968: 130). Not externally, but a touch emanating from inside, requiring all my attuning disposition, this is 're-sonance.' Or in the current vernacular, I might say that something 'has the right vibes' or that something 'reverberates' and thus gets me 'at-tuned,' if I wanted to voice that I 'got it,' that something really reached me, touched me and eventually moved me—that it did not just pass by 'without fanfare.'

Figure 15 – Water-Sound-Image, 1339 Hertz.

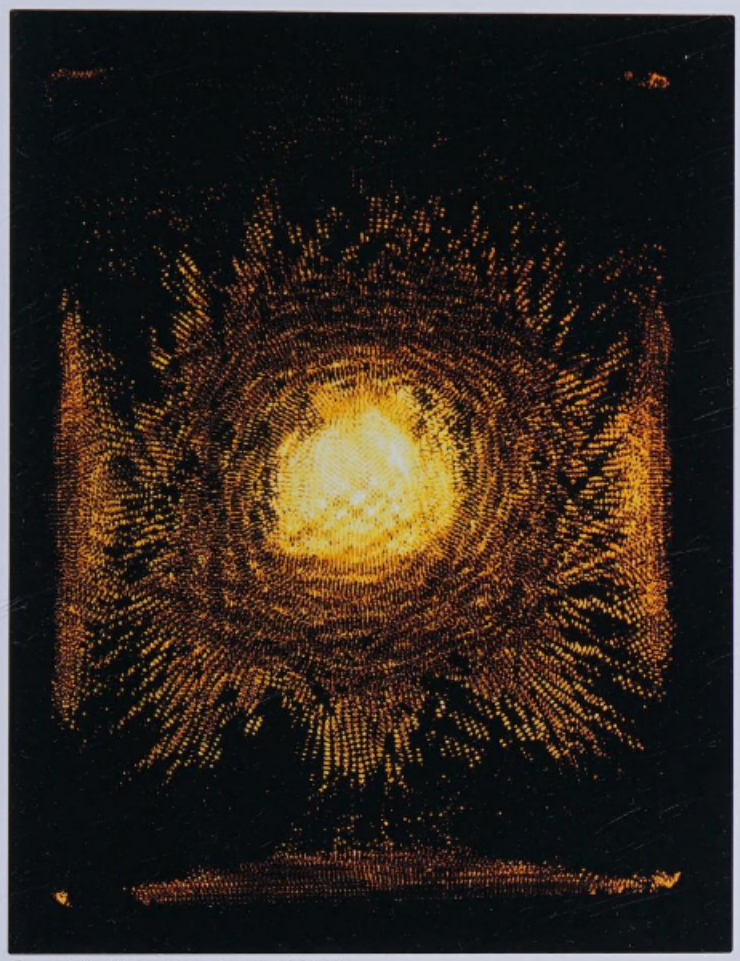


Figure 16 – Water-Sound-Image, 735 Hertz.

Clues to the question of the 'Why' of creation may be revealed in this universal phenomenon of resonance. In the countless mythological images and philosophical interpretations of the primal question of man—«Why is there something and not nothing?» (LEIBNIZ), one motif can be heard time and again: that of the awakening and the realization of consciousness. The genesis deals mostly with the 'self of the creator,' all becoming and development of the world takes place as 'self-awareness' and the 'becoming of self-consciousness' of the creator. (NICKLAUS 1994: 20, 29, 155, 176)

The longing of the primal reason for a self and self consciousness expresses itself in vibrations, in notes becoming audible. They need the resonance-body and sounding board of the world for their full unfolding and completion of their spirited reality. A Sufi is said to have received the following answer to his question of the reason for creation: «The reason that I created you is to see my sight in the mirror of your spirit and my love in your heart.... I was a hidden treasure and wanted to be recognized, therefore I created the world» (SCHIMMEL 19 95, 419, 270).

Many contemporary astrophysicists, as they marvel at the structure of the physical universe, no longer regard the cosmos as an arbitrary or even random creation. They consider the phenomenon of 'consciousness,' which they call the 'anthropic principle,' as an essential component which is suspected to have been present from the very beginning. Liberally worded, it could be stated that «The world is as it is—and not even slightly different—so that one day beings may develop, able to ask, why it is» (cp. «The dream of the unity of the universe», Der Spiegel 6/1993: 182 [German weekly magazine]).

«Spirit sleeps in the stone,

breathes in the plant,

dreams in the animal

and awakens in man.»

(Ancient Hindustani Verse)

Figure 17 – Shiva Nataraja, Indian Bronze.

WAVES AND SOUNDS

PHENOMENA AND PHYSICS

«True observers of nature, although they may think differently, will still agree that everything that is, everything that is observable as a phenomenon, can only exhibit itself in one of two ways. It is either a primal polarity that is able to unify, or it is primal unity that is able to divide. The operation of nature consists of splitting the united or uniting the divided; this is the eternal movement of systole and diastole of the heartbeat, the inhalation and exhalation of the world in which we live, act, and exist.»

(J.-W.-v. GOETHE, Doctrine of Color, 1980 I: 267)

Hindu sacred art has given us a sculpture that strikingly demonstrates the creation of the cosmos as a dance of the god Shiva Nataraja. It shows how the cosmos is created out of sound, from all-pervasive waves and rhythms, this «endlessly creative music of the universe» (NOVALIS), exhibiting its unending movement. «It collects the eternal energy in itself through a 'danced revelation' and manifests it at the same time. The forces, attracted and expelled in a raging, never ending circular motion, are the powers of unfolding, conservation and dissolution of the world; nature and all its creations are the effect of this dance» (ZIMMER 1972: 169ff). [1]

In his right, raised hand he holds a little drum, which creates the first ripples in the initially quiet, motionless, primal ocean and thus initiates the shaping of the worlds: the oscillating wave as primal form of all later forms and shapes. In India, the Sound is associated with Ether, the first of the five elements. «Ether is the initial and most subtly permeating manifestation of divine substance. From it the other elements: Air, Fire, Water and Earth, emerge as the universe unfolds. Sound and Ether together manifest the first moment of creation filled with Truth, the productive energy of the absolute in its cosmogenetic power, defining the beginning» (ZIMMER 1972: 170).

Through the alternating up and down of his two central hands, together with firm steps down to connect with the earth and to disconnect again by their lifting, so the dancing god Shiva demonstrates the primordial phenomenon of all oscillations, rhythms and waves—the polarizing change from contraction to expansion, from solidifying to dissolving, from systole to diastole, the two movements of breathing and the pulsating heart—of all-living process as a matter of fact. Seen in this light the foot stepping down symbolizes the cosmogonetic process of centripetal solidification and crystallization, materialization, gravity creating weight; the lifted leg in contrast symbolizes the opposing force of centrifugal expansion and opening up, of dissipation into total disintegration—above all though, the force of the living ascending above the already manifested, the solidified and the «ever yesterday» (SCHILLER) inert, to find an ever-new, unfolding of form in this liberating movement.

But what are oscillations in actual fact, and how can we understand their intrinsic movements and processes? The initial state, before any event, is in the simplest case, silence and no motion, an equilibrium or a «pointless uniformity» (STEWART 1998: 103), in which all force and momentum are distributed equally. In order for an event to happen so that the phenomenon of oscillation may occur, a force, usually from outside, must be applied.

[1] Standing on one leg of a humanoid shape symbolizes an illusory comprehension of self which is based on ignorance and infatuation. He has the opinion that he is able to keep himself out of these universal developments, that he does not have to participate—and this is crushed by the whirling dance of the god. (ZIMMER 1972: 171)

Figure 18 – «Basoon Players», woodcut Jörg Bühler, 1983.

An impulse must create a pressure or even a blow, 'disturbing' the initial uniformity and silence. I throw a stone into a calm lake, and circular waves unfurl as an 'answer.' Through the action of exhaling I let the stream of air pass the vocal cords, and the sound of my voice resonates through the room and breaks the silence.

This sound breaking the silence and 'disturbing' it causes a «percussion of the air», as GOETHE (1963, 39: 208) so aptly characterizes it. In relation to the sounding of musical instruments he describes three kinds of 'percussions in his *Tonlehre* (study of sounds): «to breathe into, to stroke, and to strike» (GOETHE 1963, 39: 210). Don't these three ways of creating sound inevitably remind us of ancient pictures and themes trying to describe the myth of man being approached by spirit—or better yet man being touched by spirit? The subject of such a touch always experienced deep spiritual repercussions. Subjectively this may have only been experienced as a 'disturbance,' but at the same time it contained the impulse for change and renewal—a new slant on life and living.

The impact of this percussion on the air creates a compression wave that propagates through space. But is this equivalent to the idea of a water-wave? Each impulse or pressure exerted on relatively still air causes a compression of the air molecules that had initially been evenly distributed. This compression then spreads through the air as a front. The impulse gets imprinted and becomes a moving pattern.

«A sound wave is a density wave that is created as an area where molecules move towards each other, alternating with an area in which they move away from each other. In the first area the molecules are more densely packed, in the second, they are more sparsely packed. This movement affects all molecules of an air film similarly. It is superimposed upon the random Brownian motion.» (ESKA 1997: 18) In water, waves form an up and down motion perpendicular to their propagation (a transversal wave) while the wavelike movement of air molecules (a longitudinal wave) occurs back and forth along the axis of propagation of the wave (See images to right). [2]

In order to gain a deeper understanding of the phenomenon of sound, it is important to keep in mind these two different types of oscillations. When

[2] HALL 1997:24. All electromagnetic waves like radio, light, and x-ray are transversal waves. To get an idea of the order of magnitude of pressure waves the following numbers are presented: At a normal air pressure of 1013 hectopascal [1 atm] the pressure changes from only one «ten-millionth of one pascal (the threshold of audibility above silence) to about 100 pascal which is the threshold of noise pain.» This corresponds to a «periodic amplitude of the air molecules of about 10 picometer to 0.1-0.2 millimeter,» (ESKA 1997: 73) which means the air pressure varies between «0.9999 atm in the lower density zone to a maximum of 1.0001 atm in the higher density zone.» (HALL 1997: 24)
It is surprising that our ear drums are capable of sensing the fluctuation of one ten-thrillionth of a meter (0.01 nanometer) and in the maximum accept an amplitude of 0.2 millimeter which is twice the thickness of the skin of the ear drum (cp. ESKA 1997: 73; HALL 1997: 105ff). Sound travels at a speed of about 344 m/sec in air (1238 km/h; in water 1500 m/sec, in steel 6000 m/sec). Therefore the wavelength of sound in air, according to the physical equation (speed = wavelength x frequency, where the wavelength is the distance between two pressure maxima) is 2 centimeter for the highest tones and 17 to 20 meters (!) for the lowest tones (cp. HALL

considering the usual graphical depiction of oscillation we have to be aware that even though the concept of an acoustic wave as a continuous sine wave with crests and troughs seems natural and we are able to grasp some aspects of waves more easily, it nevertheless hides a very important aspect of the phenomenon of 'sound.'

Does the continuity, suggested by the line of the sine wave, really represent the phenomenon of a sound? Or does it only show the continuity of the medium carrying the sound, the air with its pressure differences, with the crests representing the high pressure and the troughs representing low pressure? What does the continuity of the sound consist of; what is the essence of this phenomenon? The conductor Ernest Ansermet (1985: 33) remarked that «the wave is not the tone…but the condition of the air, when it transmits a tone. The air waves…are therefore a metamorphosis or a special shaping of the kinetic energy, that the air molecules receive through the sound oscillation.»[3] If it is not the air itself moving through space, «but a signal within the air» (HALL 1997: 22), what then is the essence of sound, and how does this type of oscillation of the air become an audible sound?

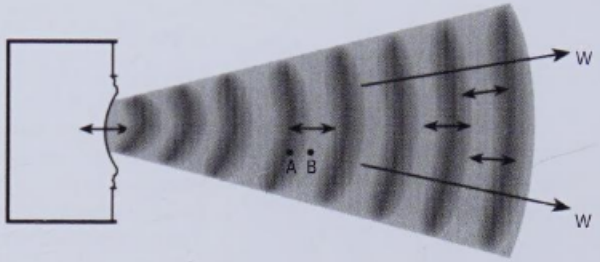
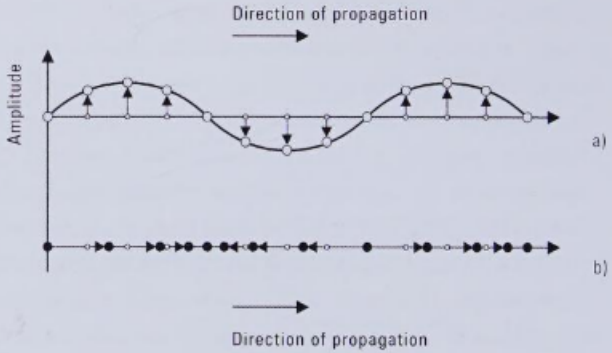


Figure 19 – Sound travels radially outbound as a longitudinal wave, emanating from a vibrating speaker. The wave-pattern travels as indicated by the arrows 'W'. The actual air particles (small, short double arrows) are moving back and forth parallel to the direction of propagation of the wave W. But they remain within a small area. The gray shaded areas depict these exaggerated zones of compression and vacuum. In reality the difference in density is minimal. The difference in pressure between compression and vacuum is in the order of thousandth of millibar. (from HALL 1997, 22)

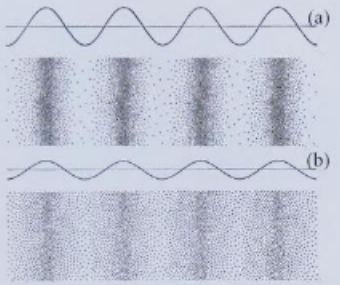
1997: 27, 36). «Let's look at a sounding tuning fork at 20 degrees Celsius in open air.... During 1 second 440 compression zones are moving away from it, one after the other. While the 441st compression is created the first has already moved away 334 meters. If sound were to be visible, a snapshot from above would show 440 complete waves, evenly distributed over 344 meters, so that the distance between two wave crests would be exactly 344 meters divided by 440. This results in a wavelength of 0.782 meter or 30.8 inches.» (HALL 1997: 36)
[Translator's note: 1 atm, or 1013 hecto pascal is the normal pressure at sea level 29.91 in/hg; 1 pico meter is one trillionth of a meter]

[3] The following remark by R. Steiner has been passed down: «Neither sounds nor warmth nor light nor electricity are waves, as little as a horse is the sum of its steps in gallop. The tone for example has a quality similar to a being and the effect of this quality when penetrating the air: a wave. For man with his senses this wave is the inducement to simulate this quality within himself, this is how the sound is perceived.» (STEINER 2000: 28)



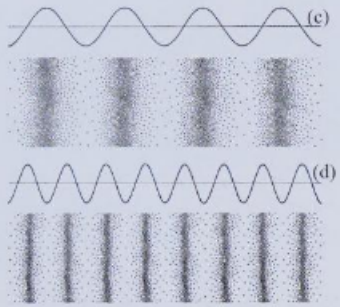
a) Transversal waves: particles are moving vertically to the direction of propagation (surface waves on water have transversal components).

b) Longitudinal waves: particles are moving in the same direction as the wave propagates (sound waves) (from ESKA 1997: 38)



AMPLITUDE

«The intensity of a sound wave (here depicted as a sine wave) depends on the extent of the compression of the air in the wave maximum. The density of the air is represented by the density of dots. The variations of the upper wave (a) are about double of the lower one (b).»



FREQUENCY

«The frequency of a sound wave corresponds to the number of vibrations per second and is measured in Hertz. It represents the number of compression maxima/minima occurring at a particular point in space during one second. The frequency of the lower wave (d) is about double the one of the upper wave (c).»

(Figure 20 – David in Winkler 1992:-152)

Let's look again at the «primal phenomenon» (GOETHE) of the process of acoustic oscillation. It consists of a repetitive change between two polar phases, the compressing and thinning of the air. Following the phenomenon back to its source, for example the resonating gong or a drum skin, it becomes clear that the basic process is a back and forth motion. The retracting 'back' is a suction that creates a vacuum thus thinning the air. The forward arching 'forth' causes a shock wave which compresses the air in front of it. This shock wave, when reaching the ear drum, causes it to be pushed inward. On swinging back, the ear drum is drawn by the thinned area of the 'back' of the oscillation and so swings past its equilibrium, thus resonating with the impacting sound.

An essential aspect of the phenomenon is therefore hidden in the alternating movements of the 'forward' (in the direction of the propagation of the sound) and the 'back' (in the direction towards the source of the sound), and in an intrinsic cooperation of the polarized forces of pressure (creating density) and suction (creating 'empty' space)—of systole and diastole. Could it be that we might have completely missed the retracting 'suction-wave,' by being so fixated on a world consisting of 'things,' on a 'Something' arising out of the 'pressure-shock-wave,' while both are inseparable and belong to the wholeness of the phenomenon?

The outward spreading dimension of a propagating wave can not be the only important aspect. Of equal importance is the permanent back-flowing towards its origin, the reference to the Source. Goethe was of the opinion that the phenomenon of color is a dialog between light and darkness. Could it be that similarly the phenomenon of sound is a dialog between past and future or even between Something and Nothing?

Up to this point we have not considered the fundamental aspect of periodicity and rhythm in our discussion of sound: the fact of repetition in time. Repetition here means that in the passage of time in the direction towards the future, we refer back to something already past: it is seized again, brought back and reapplied to the process. What occurs is a permanent communication between things past and things yet-to-be. A single short impact of an object only leads to a momentary 'click' or bang, except that the struck wood (marimba), metal (vibraphone, gong, etc.) or skin (drum) takes in the impulse of the stroke and is able to swing back and forth for a while based on the properties of its material (elasticity, thickness, etc.).

With wind instruments and the human voice in contrast, it is necessary for the impulses of an air stream to act continuously in order to maintain the sound. The same holds true for string instruments where the bow must be moved along the strings without interruption. The sharpness of the stroke or the impulse, defines the amplitude, in other words, the spatial displacement of the surface of the gong swinging to and fro determines the volume of the sound. It is the inner dynamic of the oscillation, its periodic intensity in time, the rate of movement to and fro within the oscillation, which governs the pitch of the tone (the frequency) and with that the quality of its 'signal,' its message and impact.

Wherever we look, in all macro- and micro-cosmic events, we find the world pervaded, embossed and maybe even shaped by such periodic rhythms and processes whose structures, taking shape, we meet everywhere in nature. We wonder why all these phenomena, caused by a simple movement, have their individual vibrational patterns, despite the fact that the affecting movement, as we have seen, is itself more a continuous and measured wafting, streaming or singular strike? Why does the air stream cause the vocal cords to vibrate at all, why does the blowing wind generate the «characteristic...waveforms» on the water's surface with their «periodic patterns» (GOODWIN in DEUTSCH 1994: 136)—or are these motions already inherently structured as polarities?

As long as a flow moves slowly, it remains «uniformly layered» within itself, giving rise to the name «laminar flows» (HALL 1997, 244). Only when reaching a critical speed will little irregularities develop, which can build up to true oscillations, finally becoming a genuine, turbulent flow (ibid). In order for an oscillation to develop, it is essential that turbulences—which could be seen as initial 'disturbances' or pressure shifts—always develop where the flowing, moving stream meets the surrounding still environment or an unmoving firm object. This could be conceived of as a process of interaction and equalization between the moving and the still.

This process always structures itself as rhythmically oscillating, swinging or whirling. In relation to the wave movement of water, Theodore SCHWENK writes in his book «Sensitive Chaos» (1962: 25ff.): «every force...is immediately answered by the water with a rhythmic movement. Two things are required for this rhythmic movement to come about: the water itself and another acting force. The form of the wave brings the result of this cooperation and the relationship of the acting opponents into a viewable image: she is the newly become Third, between the polarities.»

When investigating the phenomenon of the voice, we see a similar phenomenon taking place. The air streams out of the lungs and excites the vocal cords, which are elastic but securely attached to the voice box. The interaction of moving air with the firmly localized vocal cords (although they are flexible and able to move through a limited range), causes them

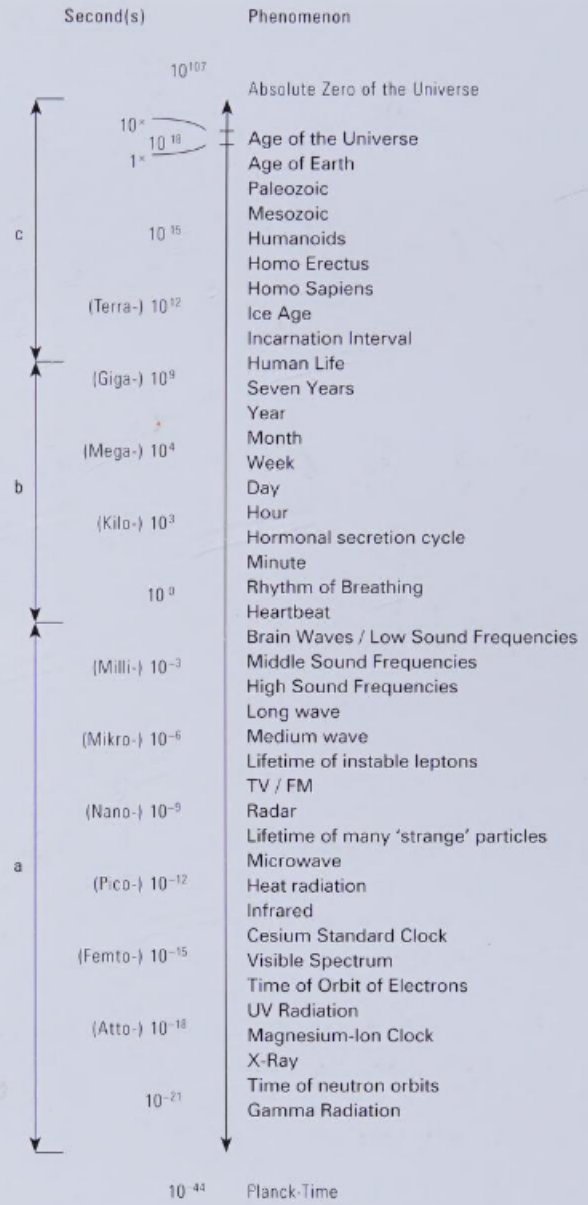


Figure 21 – Rhythms and time periods of our cosmos depicted with their respective frequency in seconds (after AUERBACK in KNIEBE (1993: 146).

Figure 22 – This beautiful vortex train is formed by drawing a brush through a solution of glycerin and water, which has been coated with lycopodium powder. The brush is moved from top to bottom in a straight line, through the solution. The interaction between the moving water in the middle and the still water on the sides occurs as a swaying, rhythmic whirl.
(from SCHWENK 1962).

to swing back and forth: first following the direction of the movement until their limit of the elasticity is reached, but then they must rebound back, due to the fact that they are firmly connected. In the dynamic tension between these two poles the vocal cords begin to vibrate, and based on the turbulences and pressure differences connected with this vibration, and amplified by the resonating cavity of the mouth—the voice begins to sound.

In a similar fashion, but only with the vibrations of the lips (e.g. horn), or a man-made reed (e.g. clarinet) the sound of wind instruments is created. The violin bow in turn strokes the string and causes it to vibrate by stretching it until it springs back. These vibrations are transmitted to the violin as a whole which now starts to swing back and forth from its equilibrium, it «trembles» (HEGEL) and thus excites the air to sound (HALL 1997: 217). Common to all of these phenomena is the meeting of the two poles of movement and stillness.

The resulting exchange leads to a 'dialog' between the two polarities, which culminates in a dynamic equilibrium of rhythmically swinging or whirling processes and forms. Something new evolves: the harmonizing and integration of stillness and movement, of permanence and change as a structured movement and dynamic gestalt. The moment of movement has integrated into itself the principle of stillness, which introduces the aspect of the permanence of structure into the continuous change. The moment of stillness has integrated into itself the principle of movement, which changes the firmly rigid into a streaming dynamic (cp. SCHWENK 1962). GOETHE (1963: 39: 173f.) called this «principle of life» the «polarity and enhancement»—it is a universal principle of matter!

If this harmonizing of rest and motion of an oscillation occurs periodically over time, in other words with a certain frequency, then a tone sounds. The tone is lower the more the decelerating element of rest is prevalent, and the tone is higher the more the dynamic element of movement comes into play. In one of the fragments from Novalis (1957, I: 703) we find a remark that tries to convey the phenomenon of light in a similar way: «Physics. Should colors be the transition from absolute movement...to absolute

Figure 23 – Surface of a marble slab.

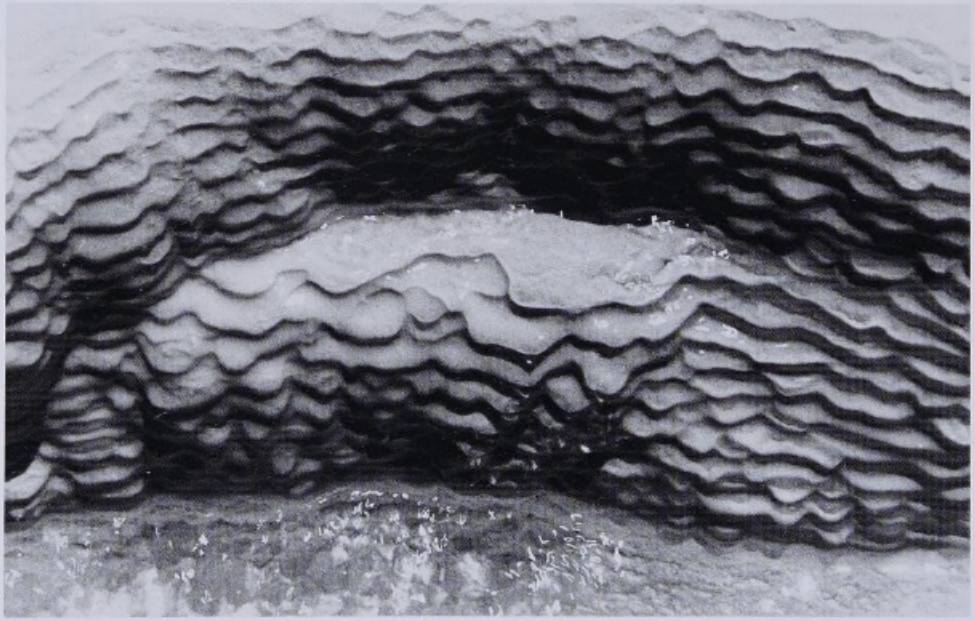


Figure 24 – Travertine terraces (calcium deposits) in Pamukkale, Turkey.

rest? Movement binds what rest disintegrates, and vice versa.» In another fragment (NOVALIS 1957, II: 103f) we read regarding the inner nature of a tone: «The tone appears to be nothing but refracted movement in the same sense as color is refracted light....A tone has an inherent connection to movement. Color is virtually a neutral state of material and light—the aspiration of material to become light and a reversed aspiration of the light. Should—in the above meaning—all nuances be a refracted state?»

Wouldn't it make more sense, not to equate the quality (or nuances) of color and tone with a «refracted state», but rather to consider them to be the attempt to overcome this break-up, the unstoppable push, to bridge this primordial chasm between light and darkness, movement and rest, something and nothing, future and past, and to «unite the divided?» (GOETHE 1980, I: 267)

[Translator's Note: The English words *refract* and *break* are both represented by the German word *brechen*. Equating the two meanings is a play of words that is not translatable into English]

As color spans the range from light to darkness; as the rainbow arches between heaven and earth, these phenomena have long symbolized the idea of borders, of space creating separation and distance; and as the colors engage brightness and darkness in an accelerated process that looks nearly like a dialog; in a similar fashion could not the sounding be an expression of a constructive tension between movement and rest, something and nothing, a yelling protest against the dividing (or even tearing) dimension of time? The note in its swinging «double-movement» (GOETHE) connects the divided past and future and in this way carries the lost «primal unity» (ibid) to a resounding present.

Every tone would therefore be, foremost a painful outcry—born out of utmost distress—against this split within time itself, but which, as sound, already conquers the separation and witnesses the deeper truth of inner unity, praises it and even celebrates it joyfully. In the original meaning of the word 'tone,' which is derived from the Greek word *tonos* (for tension, rope, string, tendon, tension of voice), this element of 'tension' is very

Figure 25 – Skull-seam of a human (L) and of a deer (R). When the first phonographs were developed R. M. Rilke was very surprised to find the similarities in the structure of the grooves of a record with the seams where the scull-plates adhere. He wrote an essay entitled «Primordal Noises» which he ended with the words: «My idea now is that the crown seam of the skull has—let's assume this—some similarities with the densely waving line cut by the needle of the phonograph into the receiving cylinder of the apparatus. What would happen now if we tried to trick that needle? We would offer it, on replay, instead of the graphical translation of tones, something natural occuring. OK, let's say—the crown seam. What would happen? A sound would develop. A sequence of notes, music ... emotions—but which? Incredulity, shyness, fear, reverence—yes, which of all the possible emotions? What emotion stops me to name this primordial sound being born here? Let's think of this, all the different lines we could investigate and test. Which contours could we, in this way, complete, to have it then reappear, metamorphized, accessible to different senses?»

(RILKE 1976b, 11: 1085)

Figure 26 – The edges of all these leaves have their own characteristic structure, their rhythm, their vibration, their sound.

much alive with a force that bridges and connects the separated. So we find in Heraclitus, these remarks, derived from his thoughts: «They do not understand how something so far apart can be so close within itself: opposing unification as the bow and the lyre» (DIELS 1963: 26); and: «the opposing intoning together and from a discord the most beautiful harmony» (HERACLITUS 1965: 9). Thus harmony would not only be possible between several notes, but also as an inner event, as the heart of each note or tone. The word 'sound' [Translator's note: German *Laut* which has the same root as the English word *loud*] or rather 'loud' with its inflection 'louder'—meant qualitatively and not quantitatively—doesn't it contain within itself the meaning of 'pure, clear, bright, unspoiled, unmixed' as an expression of a pure, undisturbed vibration in agreement with itself, of an inner harmony? Would not 'Sound' [German: *Laut*] in its primal meaning, be the qualitative characteristic of a pure, clear, full-sounding vibration that only through this purity becomes perceivable; that because of this quality can be distinctly heard and perceived, and that only through this is capable to touch, move, to create resonance? This is also the actual meaning of 'twang' [German: *klingen*]: «to emit a bright sound, sounding; well-sounding, effective» (PFEIFFER 1999) thereby inviting one to 'tune-in,' to re-sonante. Only sound is re-sounding.

»Higher physics: The center point is a consonant—as is the periphery (of the universe). The contemplation of the world begins in infinity—with the absolute highest tone in the center, and moves down the scale—the contemplation of ourselves also begins with an infinite, with the absolute lowest tone at the periphery, and moves up the scale. Absolute unification of bass and treble. This is the systole and diastole of divine life.« (NOVALIS 1957,-I:-138)

Figure 27 – Chladni Sound Figure, 11,381 Hertz.

«The primal sound

From far away
the bagpipe sings
its monotone and eternally chang-
ing
Melody:
Endlessly
heaves and sags
above the primal sound
its unimaginable game.

.....

On the iron table
Infinity
lies sand immensely spread.
There strokes a bow
the table.
A note
swings and sounds
the feverish plane.
And look!

The sand
rises and whirls
into thousands of shapes.
Out of those,
the dancing
sounding
glowing
dances slither,
choirs bind,
wreaths twine,
surround,
abscond,
finding each other again

.....

But throughout the game
of form, color and sound
the low primordial sound
hums
endlessly
dominating
terrifyingly incomprehensible.

.....

fading into the distance
the bagpipe's
monotone and eternally changing
melody.
Village, Forest, World
lost to me
hushed
in the night.»

(Christian Morgenstern, The Primal Sound, 1974: 39f)
[Translator's Note: Christian Morgenstern (May 6, 1871–March 31, 1914) was a German author. Morgenstern's poetry, which was inspired by English nonsense rhymes, is immensely popular. Many Germans know some of his poems by heart. His philosophical and mythical works were largely influenced by Nietzsche, and Rudolf Steiner, the father of anthroposophy.]

Oscillating Plates

Towards the end of the 18th century the natural scientist Ernst FF. Chladni (1756–1827) set about researching different acoustic phenomena of oscillating surfaces and bodies. In his most well-known experiment, he spread sand over thin glass plates, and by stroking the edge of the plate with a violin bow, set them into vibration.

Thus he discovered the striking phenomena, which came to be called «Chladni sound figures» that so impressed the world. In his work «Acoustics,» published in 1802, he presented many elaborate drawings displaying the forms and patterns that were exhibited in the sand. His work was described by Wieland as «The art of drawing with sound.»

With these experiments he succeeded, perhaps for the first time ever, to show that sounds not only touch and move the soul but are also capable of effecting tangible substances and to even form and shape them. Surely if such a phenomenon, so obvious and so easily understandable, would have been known about in ancient times, Plato would have mentioned it in his writing and it would have been passed down; and Johannes Kepler would have mentioned it in his great work about the «Harmonies Of The World» and he would have discussed it extensively as a miraculous example of the creative power of sound.

Even though it was only single notes that miraculously created those sound figures with their lines and patterns—witnessing these spontaneously, self-drawing images stimulates in ones imagination, an immediate and innate understanding of the creative powers of sound. Through the visual senses, a faint recognition of this «Infinitely Creative Music of the Universe» (NOVALIS) now became possible.

Beside the Englishwoman Mary Waller (SHEN in WINKLER 1992: 122), and the American, Margaret Watts Hughes at the turn of the 20th Century, it was primarily the Swiss physician, natural scientist and painter, Hans Jenny (1904–1972) who breathed new life into Chladni's work in the early 1960's. Using a variety of different materials and radically different experi-

Figure 28 – Ernst Chladni during a demonstration of his sound-figures, 1800 (from KRÄTZ, 1998).

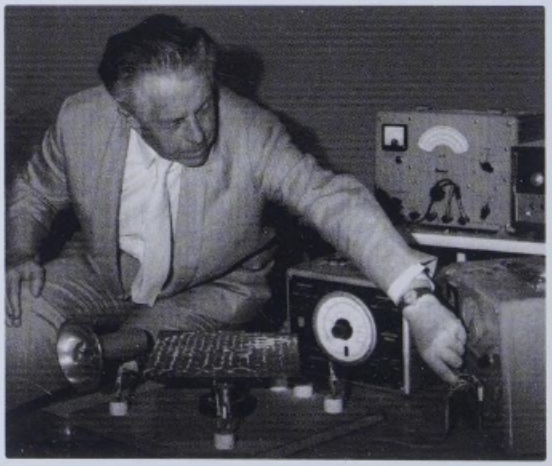


Figure 29 – Hans Jenny in his Cymatics laboratory (JENNY, 1972).

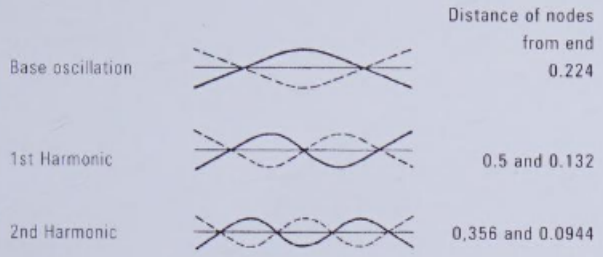


Figure 30 – Ideal oscillation of a free cylindrical rod.

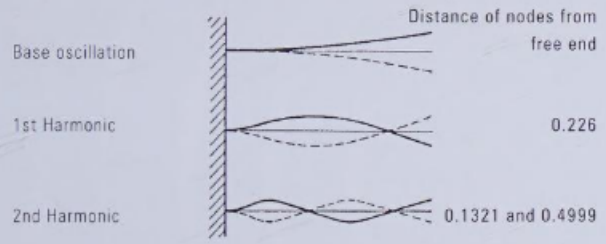


Figure 31 – Oscillation of a rod fastened on one side.

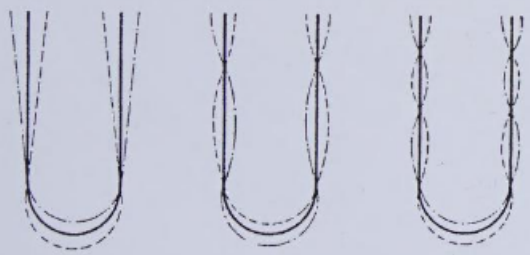


Figure 32 – Base oscillation and harmonics of a tuning fork.

(From Gerthsen/Vogel 1993).

mental techniques, especially widening the scope of the materials used to liquid substances, Jenny succeeded in visually demonstrating a multitude of phenomena by using single tones, intervals and even music. Coining the name «Cymatics» (from the Greek *to kyma*, the wave) he documented over 12 years of experimentation in many publications and books with spectacular photos and films (Jenny, 1962, 1967, 1972).[4] These films have been re-issued as DVDs, and the two volumes of Jenny's books have been re-published as a single, hardcover edition. (See reference pages.)

While Chladni vibrated his plates using a violin bow, Hans Jenny used a variety of experimental techniques, including stretching rubber membranes over loud speakers, and also mounting piezoelectric crystals directly to the steel plate. (JENNY 1967: 18). These crystals, which could be attached at any point on the bottom of the plates, were then wired to a frequency generator, whose current set the crystals vibrating, and which in turn, set the plates into oscillation.

The present author developed a new kind of sound transducer [5] that was directly coupled to the bottom of the plates. The «Chladni sound figures» displayed in this volume were generated using this transducer. In most cases, the exciting frequency is fed in at the center of gravity, (the point where the plates are supported), so that it is can oscillate without any damping or obstruction.

Whether it be strings, rods, membranes or plates, as soon as they start oscillating, the interplay of widely oscillating areas (the anti nodes) and resting lines or points (the nodes) begins. It begins with the most basic oscillation, the *eigentone*, continuing with the harmonics, or the overtones, dividing

[4] Also to be noted: Manfred Kage with his development of the audioscope and Margarete von Löwensprung (München), who worked intensively with the tonoscope (a device to visually show the Chladni sound figures of human language, originally developed by Hans Jenny). [Ed. note: In the 1890s, American, Margaret Watts Hughes, also documented an extensive series of vocal patterns by singing into her Eidoscope. These patterns reflected archetypal formative patterns in nature, such as brachiation and a variety of floral patterns]

[5] This sound converter is based on a design by Helmut Lua, a HiFi manufacturer in Frickingen, Bodensee; see Epilogue.

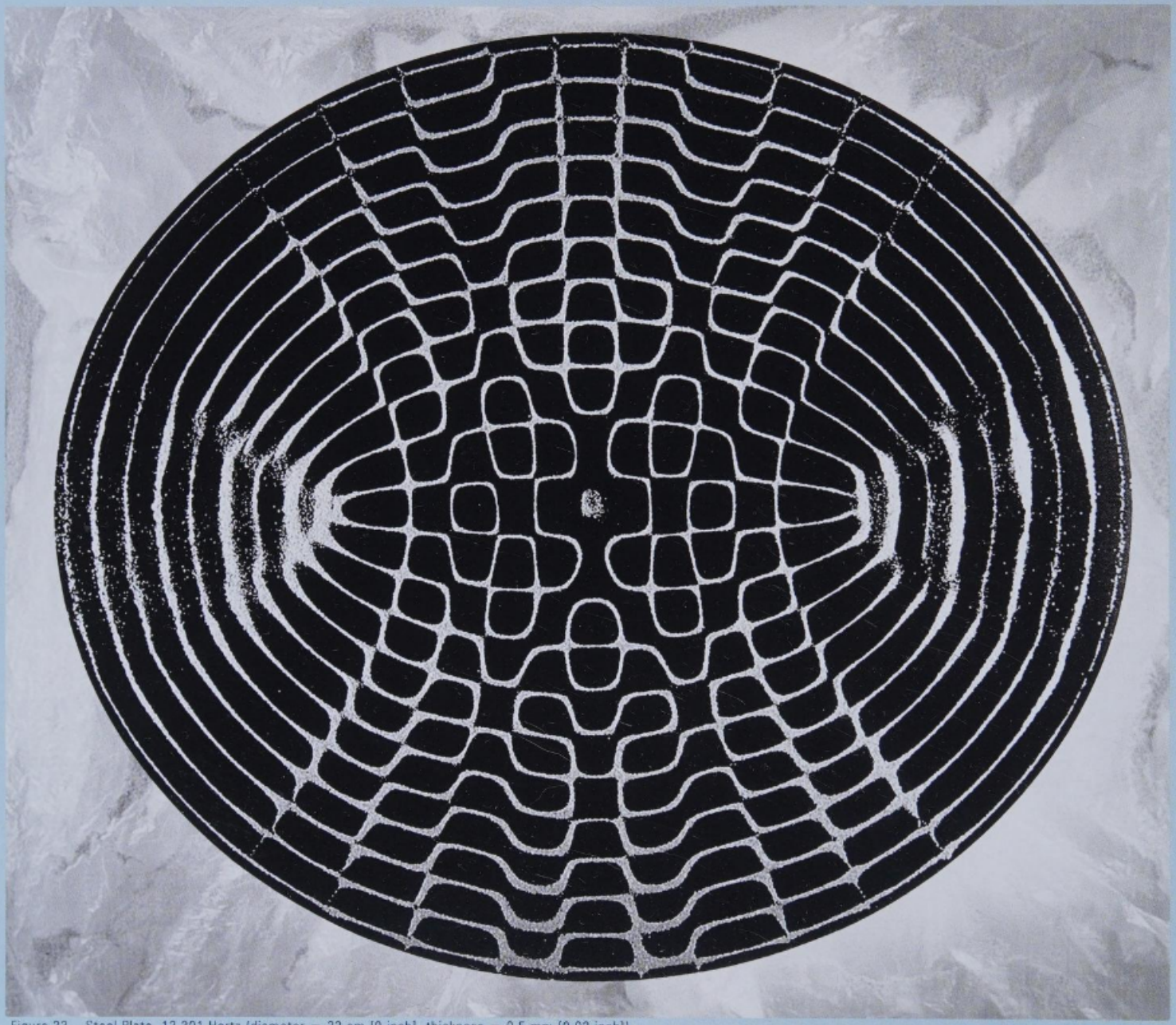
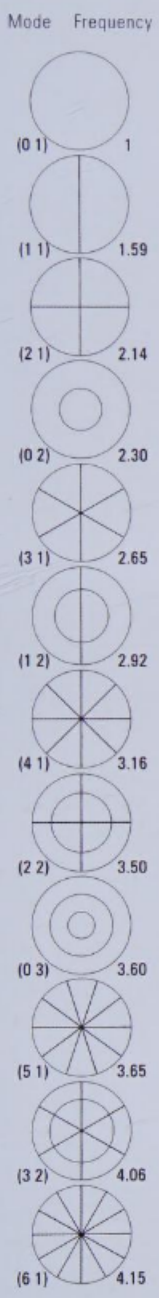
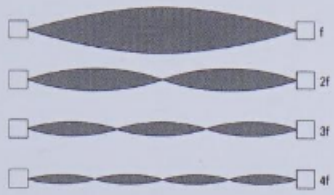


Figure 33 – Steel Plate, 12,301 Hertz (diameter = 23 cm [9 inch], thickness = 0.5 mm [0.02 inch]).





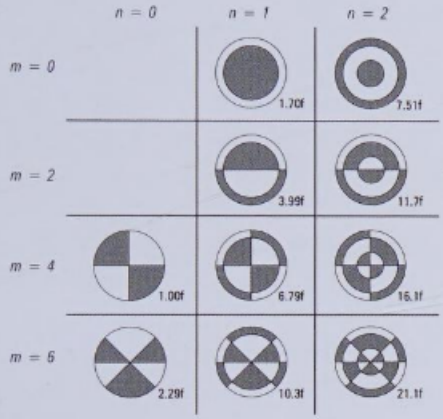


Figure 34 – Top:
The base oscillation and higher harmonics of a body of specific pitch and timbre. In a plucked string the harmonics occur at even numbered multiples of the base frequency.
A round plate oscillated in modes (oscillation patterns). Their frequencies don't have a simple mathematic relationship. Here the frequencies depend on the number of node lines in the sound figures. Node lines are non-moving areas of the oscillating surface. The nodes of a round plate are identified by the number (m and n) of their radial and circular lines. The node lines separate areas that at any time oscillate in opposite directions (indicated by the gray and white shapes) (SHEN in WINKLER 1992: 122).

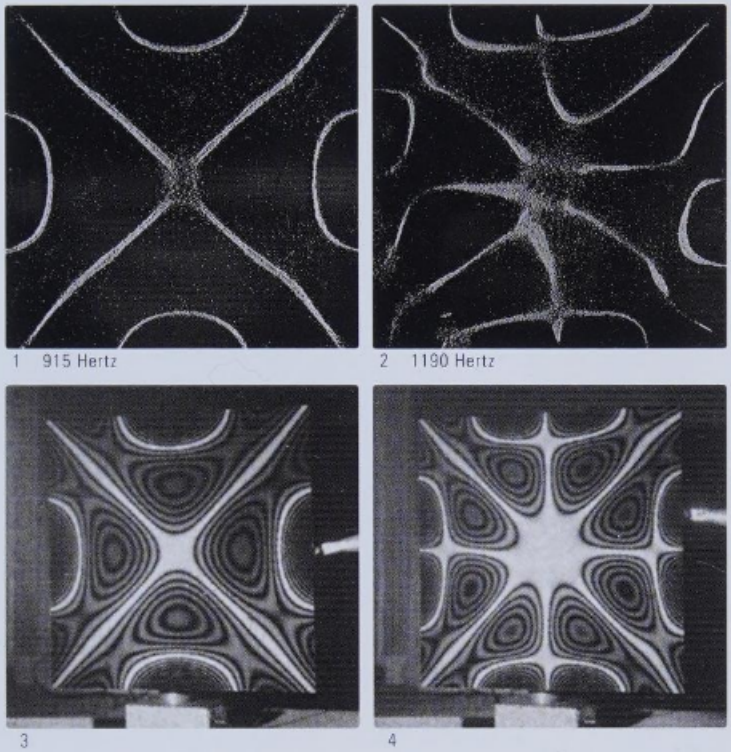
Figure 34 – Left:
The node lines of the twelve lowest modes of an ideal membrane, starting with the lowest frequency. The pertinent frequency is indicated to the right of each graphic, expressed as a multiple of the base mode (01). The sequence of the frequencies of an ideal membrane is not harmonic (ROSSING in WINKLER 1992: 131).

and overlaying them. The node lines and points always correspond to the spatial location of the point of fixity, the mounting point of the object. But in the oscillating antinodes we become aware of the element that disturbs the object from its inertial persistence. This dynamic impulse excites the resting object out of its equilibrium and makes it tremble, unsettling its internal cohesiveness, its self-composure. Thus the impulse opens up the material to another reality: to the sound and its creative power.

If a thin metal plate (V2A-steel, 0.5 mm thick, about 30 cm [1 ft] diameter) is excited in the described fashion by a tone of 12,301 Hertz, this means that the whole plate moves up and down 12,301 times per second. As a result of the limited flexibility and the inertia of the material, the whole plate cannot follow this movement uniformly and consistently. Instead, it takes on a wave form as shown in Figure 30, Page 39. Lower frequencies are accompanied by extensive wave structure, while higher frequencies are much more finely structured. If the plate has been covered with fine sand the wave pattern may be clearly seen. In areas of strong oscillation the sand is flung away and comes to rest in the area of nodes. This is the process that creates the «Chladni sound figures.»

In all plates shown here, the dark areas correspond to the oscillating zones of vibration and the bright bands and lines, formed by the sand, to the resting node-lines. The patterns and structures of the Chladni sound figures thus make visible the relationship of movement and rest in the oscillating plates. We can clearly see the phenomenon of the polarity of contraction and expansion, of rest and movement as an essential aspect of the patterns of vibration as described in the chapter «Waves and Sounds.» The node lines represent the transition between some portion of the surface moving up and neighboring fields moving down. The node line portrays the boundary of two such fields moving in opposite directions.

Using modern laser techniques these movements and the related spatial bending can be clearly demonstrated. Figure 35, on the following page, depicts two different patterns of oscillation—called modes in physics—of a plate at different frequencies; the top two images as a Chladni sound figures, and the bottom two as holographic laser images (TAYLOR 1994:



1 915 Hertz 2 1190 Hertz

3 4

Figure 35 – Two oscillation patterns (modes) as Chladni Sound Figures (1,2) and as a laser-holographic simulation (3,4 after TAYLOR 1994: 103).

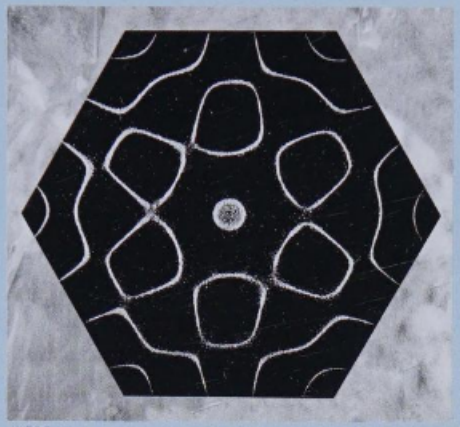
102ff.). The bright lines formed by the sand in the Chladni sound figures correspond to the very bright lines and bands in the laser-hologram and the black surfaces of the antinodes to the patterns of black and gray. The nicely visible 'interference lines' in the laser-hologram are comparable to contour lines on maps, making the different elevations of the undulating surface visible.

Besides the amplitude and the pitch, which are the essential influences determining the shape of the Chladni sound figures, the character of the particular pattern in the sand depends on the shape of the plate itself.

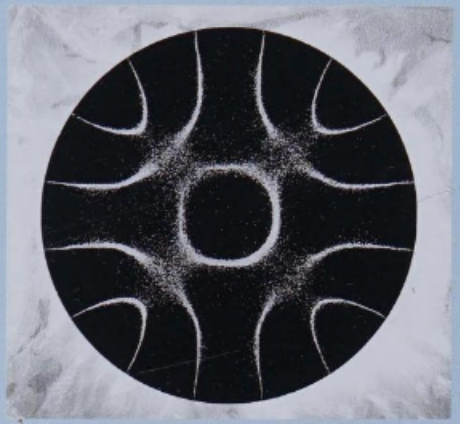
However, in the center section of different plates we recognize specific, basic forms, that seem to be independent of the boundary of the plate. Inevitably we are drawn to ask, »What is the basic question for the origin of these pattern and figures? Are they expressions of structures that are intrinsic to the plates that are 'awakened' by the vibration of the sound? Or do they belong to the specific energy patterns of each tone, which momentarily captures the material and imprints its signature into it? Or do they emanate from an as yet unknown force field which gives order and structure to the visible and tangible world and which has been transferred to the plate through the vibrational impulse?« To limit the subject of questioning and carefully approach any answers, we have to consider further elements of influence besides the pitch and form of the plates.

One such element is, where on the surface of the plate is the exciting tone induced? Specific figures will arise if stimulated in a specific spot, be this at one or several corners, along one of the edges, exactly in the middle, or at any specific point on the surface of the plate. It is also crucial if the oscillation of the plate is attenuated at one point (for example by grasping it with the fingers or pliers), so that nodes would develop at these points. With the basic shape of the plate being the same, other elements that have an effect are the size, the thickness, the material (brass, steel, bronze, etc.), the homogeneity of the material and whether the plate was cast or milled. Also the temperature distribution within the plate (JENNY 1967: 30), the surface structure, like painted or unpainted, and even the type of lacquer (e.g. acrylic or oil based) effects the formation of the figures. All these factors change the *eigenfrequency* of the oscillating plate significantly—just as each bell, each gong produces its own sound when struck. As all these conditions of resonance are governed by this *eigentone*, of which the Chladni sound figures are the immediate expression, we can make the following observation: A specific tone will only bring about the same oscillation patterns and sound figures if all factors are identical. Then and only then, can we create identical patterns with a certain tone. This means that all sound figures that are created by oscillations are the result of 'argument and consent' between stimulating oscillation and agitated medium. They are the expression of a 'dialogue,' a dialogue between the vibration of the tone and the 'answering' matter, between the motion

5272 Hertz.

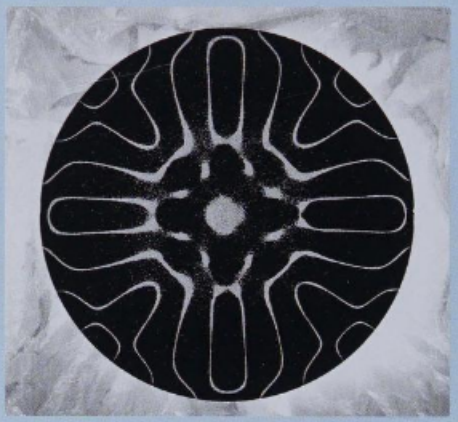


1600 Hertz



1079 Hertz.

2150 Hertz.



4341 Hertz.

2515 Hertz.

5889 Hertz.

Figure 36 – Chladni Sound Figures of differently shaped plates.

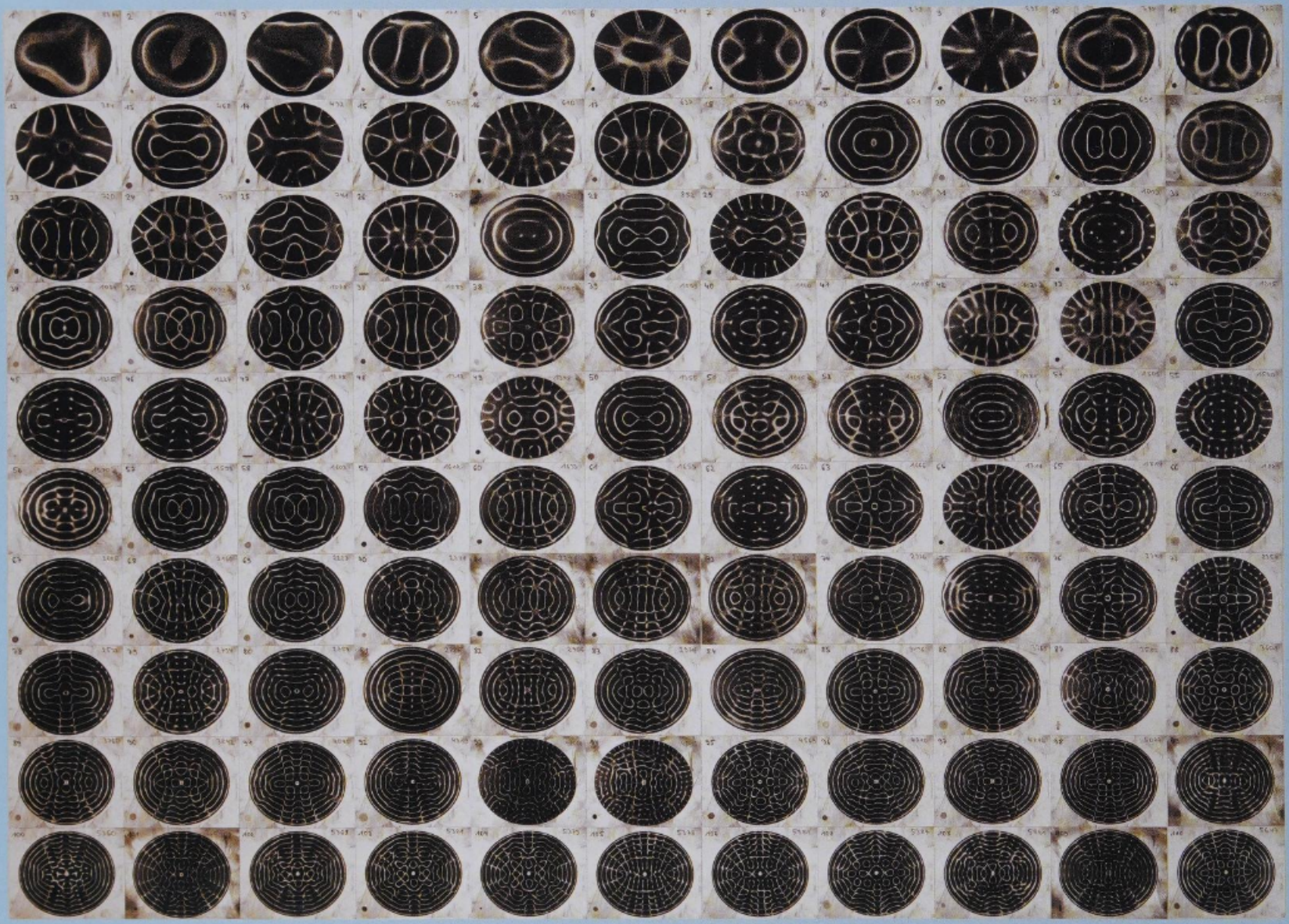


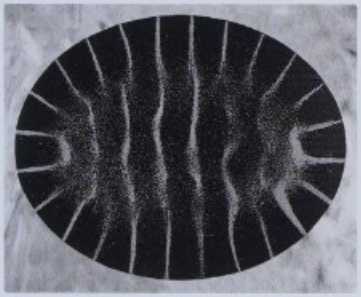
Figure 37 – Chladni Sound Figures on the same metal plate excited by gradually ascending frequencies throughout most of the audible range, from about 100–20,000 Hertz.

energy contained in the vibration, and the matter which is either resonating in co-movement or paused in inertia, 'unwilling' to participate.

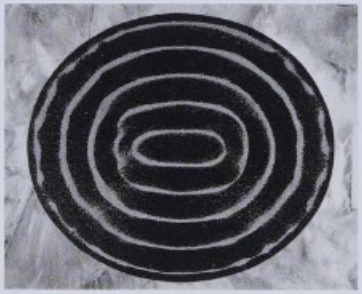
By examining a progression of images portraying how node lines form on an elliptical plate subjected to continuously rising frequencies (See Figure 37, Pages 44 and 45), the following processes and principles of the formation of Chladni sound figures can be delineated. It is interesting to note that in this and similar experiments the author observed that a plate had to be 'broken in' (just as an instrument needs to be attuned before it can sound its best), before the greatest number of figures appeared in their clearest form.

By photographing a large number of these forms and patterns and arranging them in a sequence of ascending frequency, the following basic observations become apparent:

1. Upon achieving the clearest, most distinct form of the particular sound figure, the plate also produces the most intense, purest and «most decisive» (GOETHE 1963, 39: 208) audible tone.
2. The lower the frequency, the grosser are the sound figures, having denser lines with less articulation, or detail. As the frequency increases, they become more intricate and the number of lines increases. Figuratively one could say, that the sound figures exist between the greatest oscillation—the lowest frequency at which all the sand flies away so that only the black plate remains, and the finest oscillation—the highest frequency at which the node lines are so close together that they can not be distinguished with the naked eye and the whole surface of the plate appears bright, covered with sand.
3. Two basic forms of node lines can be distinguished: radial lines that often run through the center (Figure 38-1) and spherical or elliptic lines that repeat the outer form of the perimeter (this is especially true for

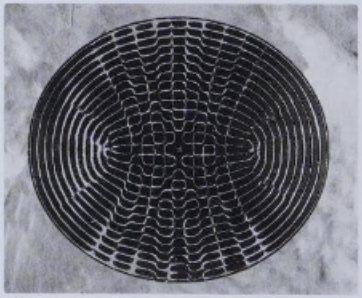


1



2

3



4

5

Figure 38 – Basic shapes of node lines: radial node lines (1: 1149 Hertz), spherical (2: 1477 Hertz, 3: 3363 Hertz) and superposition of both shapes (4: 17,789 Hertz, 5: 4885 Hertz).

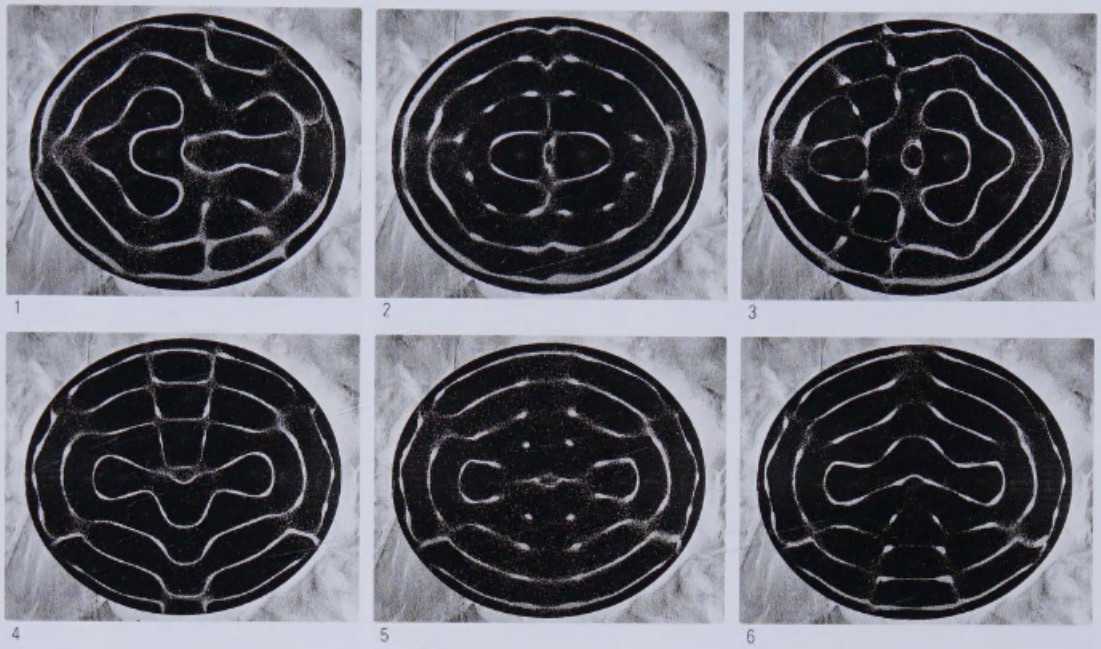
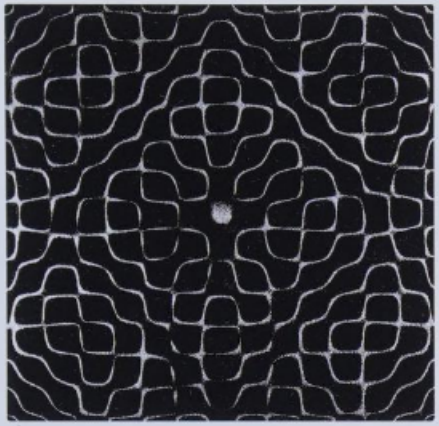
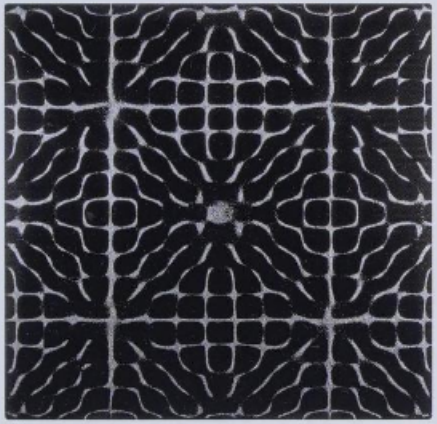


Figure 39 – Asymmetric sound figures along the longitudinal axis (1, 3) and along the lateral axis (4, 6). Symmetric figures (2, 5).

Figure 40 – Phase shifted pattern of oscillation: where we can see light node lines in 1, we see dark areas of maximum amplitude and vice versa in 3. 2 shows the transition of this phase shift (1: 11,464 Hertz, 2: 11,473 Hertz, 3: 11,477 Hertz).



1



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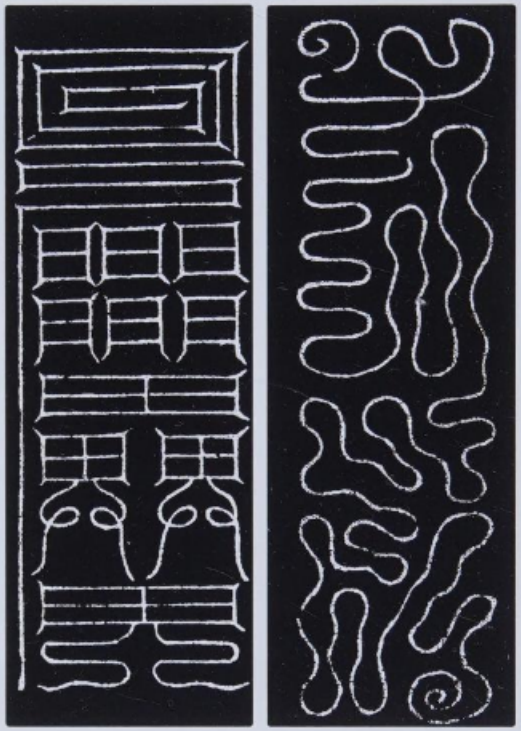


3

4

Figure 41 – Of interest here is the phenomenon where the sand does not remain still, but wanders and streams perpetually along the node lines. As with waves in a river, a constant shape remains despite the fact that the substance itself is continually flowing through the form. The images on the right (3, 4) show two such streaming forms. On the left we can see more «static» sound images (1, 2). Comparing these two forms—the streaming and the static—we observe how the dynamic form appears much more fluid than the more strictly geometrical order of the static form. In the center panel, we can see definite parallels in the character of these images to the two primal forces of the ancient Chinese Taoistic tradition, as depicted in this print from an ancient stone relief. The fine line in the left panel image expresses «the sharpness of the yang element» while the right, «the sinus motion of the yin element» (middle images from RAWSON / LEGEZA 1987: 54).

round or elliptical plates (Figure 38-2,3). Most of the sound figures consist of a combination of those two types (Figure 38-4,5).

4. At some frequencies asymmetrical shapes develop within small frequency steps, either along the longitudinal axis (Figure 39-1,3) or along the lateral axis of the ellipse (Figure 39-4,6). In between these asymmetrical forms, symmetrical shapes always appear. (Figure 39-2,5).
5. At some frequencies a kind of phase shift can be observed that occurs within a narrow range of frequencies (Figures 40-1,2,3 occur between 11,464 and 11,477 Hertz). Here 40-1 and 40-3 belong together. Where there are bright node lines in 40-1 (resp. black surfaces) we see black vibration surfaces in 40-3 (resp. bright node lines); 40-2 depicts the transition of this phase shift.
6. Occasionally the sand does not remain at rest along the node lines but begins to wander and stream along those lines, sometimes even twirling (Figure 41-3,4).
7. Upon close examination of a sequence of sound figures one notices that not all patterns are completely different but that individual form patterns with clearly distinct signatures appear repeatedly. While retaining the basic shape or structure, a new spherical ring is formed with each repetition of the sound sequence. Often at the seventh repetition, a kind of metamorphosis of this primary pattern occurs, and following this only minor additional differentiation occurs again up through the last form. This sequence of repetitions is depicted in figure 43.

From this arises the surprising phenomenon, that visible sand sound figures display something like an 'octave' of patterns. But the corresponding intervals do not match the musical octaves and thus also the harmonic overtone sequence. The intervals after which the primary pattern is repeated, decrease from repetition to repetition, forming a hyperbolic curve when graphed in metric divisions (Figure 42).

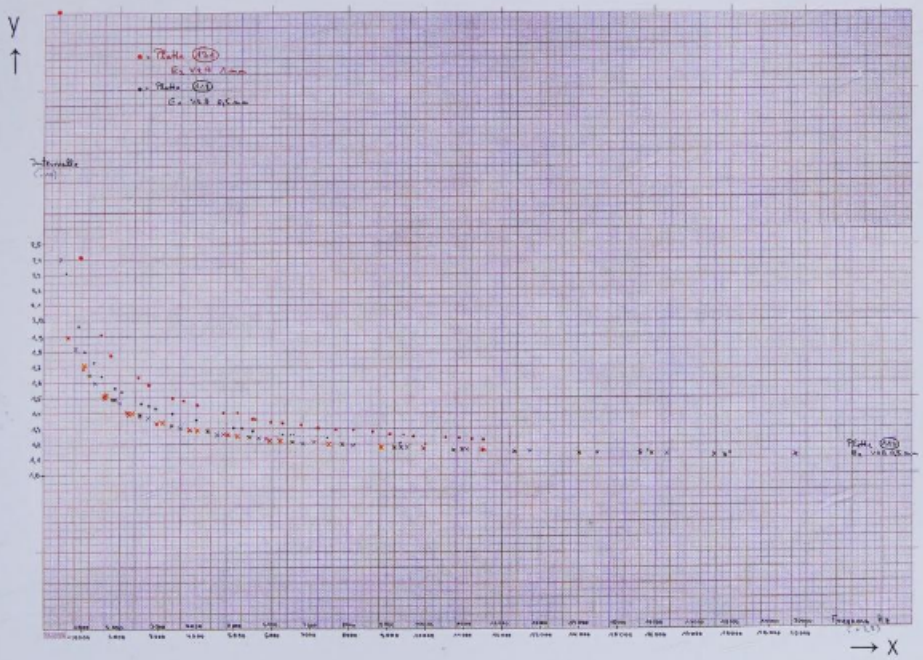


Figure 42 – The graph shows the set of a sound image theme of three different metal plates. The frequency (x-axis) is plotted against the proper tone interval (y-axis; 1 = fundamental, 1.5 = fifth, 2 = octave).

The intervals of the frequencies which produce similar schema (same timbre), gets smaller and smaller following a logarithmic progression. All intervals of one theme lie on one common curve (plate , V2A, 0.5 mm).

The two other curves depict the characteristics of two different plates:

1. Black series of points = smaller ellipse than the main curve, same metal, same thickness.
2. Red series of points = same ellipse as main curve, same metal, thickness 1 mm.

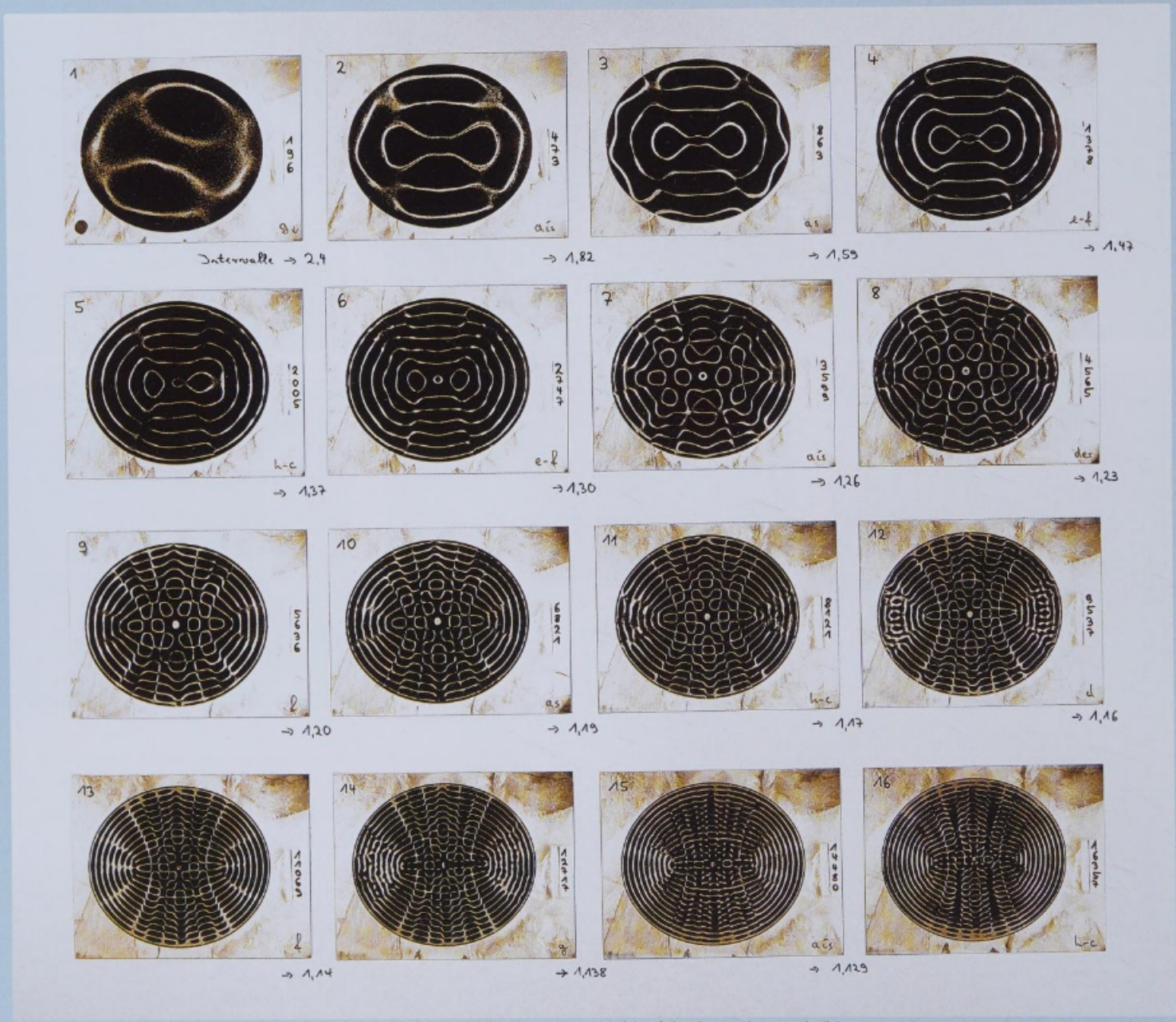


Figure 43 – Repetition of a theme type in decreasing intervals (the frequency is indicated to the right of the plate, written vertically).

1 S Intervalle → 1,958

2 Sphären 2 Radiale → 1,625

3 S 2 R → 1,491

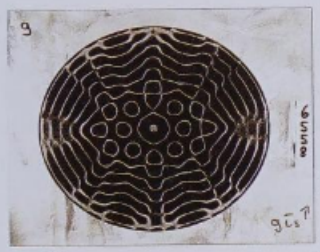
4 S 2 R → 1,396

5 S 2 R → 1,328

6 S 2 R → 1,283

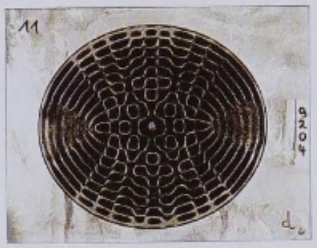
7 S 4 R → 1,247

8 S Transformation 12 R → 1,217
6

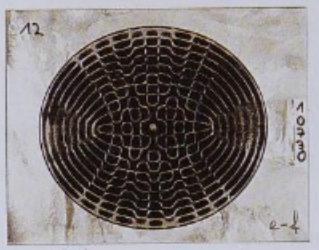


9 S
7
→ 1,194

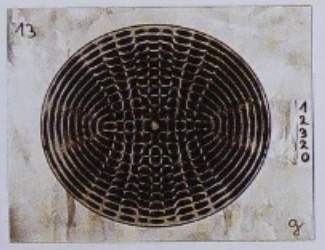
10 S
8
10 R → 1,174



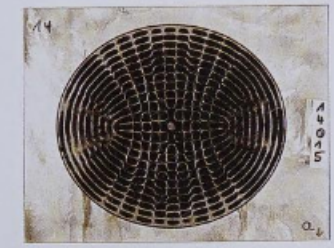
11 S
9
10 R → 1,165



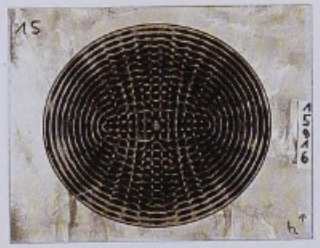
12 S
10
10 R → 1,148



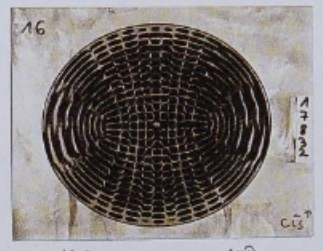
13 S
11
10 R → 1,137



14 S
12
10 R → 1,135



15 S
13
10 R → 1,120



16 S
14
10 R

The phenomenon of the Chladni sound figures is not only interesting for aesthetic or scientific reasons, it also found a practical application in the construction of musical instruments. Specific wood boards can be analyzed in this way to produce an optimized sounding body (HUTCHINS in WINKLER 1992: 88ff.). From this we can gain fundamental insights into the phenomenon of resonance.

In the images to the right (Figure 44), we can see clearly how the clarity and structure of the particular sound figure associates with the quality of the vibration and with the wood's ability to resonate—or stated differently, its willingness to resonate. The base of the violin shown at bottom left (d) displays evenly symmetrical and most notably, fine node lines, while the other bases show not only uneven lines, but more significantly, coarse or even diffused lines.

The gradual development of the structure of the node lines is portrayed in the image below (Figure 45). As the volume is increased, larger and larger areas of the violin base are excited by the oscillation. The dark sand, which is initially evenly distributed (a), moves from the periphery (b), and gathers in the middle (c). Since not all areas of the wood resonate with the same strength at any given pitch, we observe that the sand remains distributed in a wider area in some places than in those places with clearly formed node lines. This phenomenon suggests that the wood does not really resonate in these areas, thus not actually 'participating,' remaining at rest. The material character of the wood denies itself to the principle of movement, remaining at rest within itself and in its substantiality. And this is exactly the meaning of inertia: to egotistically withdraw from any attempt of being addressed, touched or moved and thus closed to any form of resonance or response. [Translator's Note: the German word *Trägheit*—inertia, strongly expresses the idea of the refusal to move or to participate.]

The more we scrutinize these phenomena the clearer we feel how similar these processes are to our own mental conditions, events, and experiences; whether we are reachable, accessible, receptive, open-minded, or

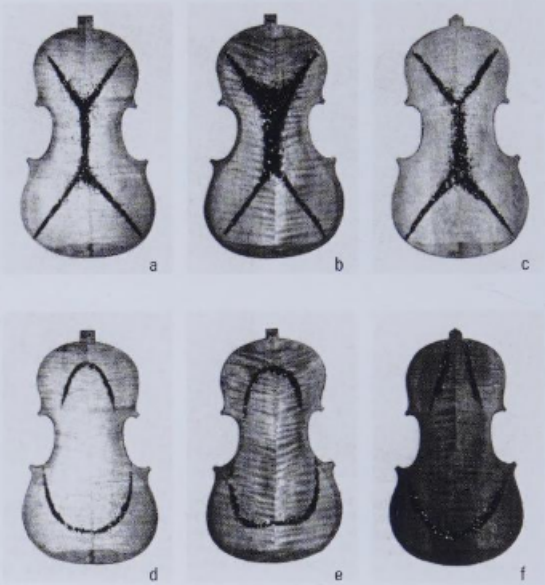


Figure 44 – The sound images of mode 2 and 5 show clearly if a sounding board is tuned well or not. On the left side we see a violin board that has exactly the right pattern in mode 2 (a) as well as in mode 5 (d). The middle board is correct for mode 5 (e), but for mode 2 the upper node line is too high (b)—indicating that the board is too still at this point. The right board is too thick in the middle upper part, so that at mode 5 two separate lines appear (f), instead of one circular closed node line (HUTCHINS in WINKLER 1992: 95).

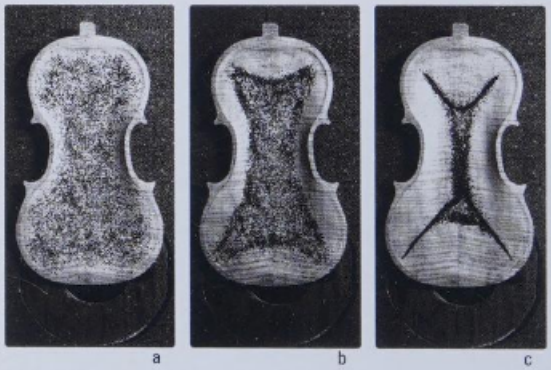


Figure 45 – (Hutchins in Winkler 1992: 92)

on the other hand, uncommunicative, immobile, inert, untouchable, withdrawn within ourselves, hardened, obdurate or even petrified.

The euphonious instrument is therefore one in which the wood resists the principle of movement the least, where a maximum of material character becomes pulsing vibration. The pure substantiality develops into the resonant sound-body becoming nearly alive—this movement back and forth around the resting equilibrium echoing the movement within the atom, diastolic expansion (going far beyond oneself) and systolic contraction (introverting far more than normal).

Hegel's contemplations regarding the vibration and sounding of musical instruments from his discourse «Aesthetics,» is most insightful in this regard. For him it is the process of overcoming the «hitherto quietly within-itself existing materiality» [its dormancy, or inert material nature, Ed.] which is the birth of the sounding tone. «The abolishment of 'spatiality' thus only consists of the process where a particular material forgoes its restful form, starts to move, but quivers within itself in a way that every part of the coherent body not only changes its location but also strives to be relegated to its previous condition. The result of this oscillating quiver is the tone.» Through this «inner quivering of the body», the becoming a vibration within its otherwise rigid spatial limitation, the «quiet material form» loses its hitherto exclusive identity, so that suddenly something more embracing, something deeper, «more ideal…than the physicalness existing as its own reality» can emerge.

Hegel calls this *Seelenhaftigkeit* (the characteristic of having a soul) (HEGEL 1986: 134f.). As the tone resounds in a «quivering of spatial existence» (ibid: 173), it is the «first inner ensoulment which stands up to the plain sensory unfolding and emerges as a perfect oneness of all physical characteristics…through the negation of the real spatiality» (ibid: 173). [Translator's Note: The image is painted of the material reality on one side—rigid—then life is breathed into it. There is the upheaval against the plain existence of sensory experience and by negating the pure physical form, something new emerges which is now contained as something perfect in all physical existence]. The representative and immediate expression of this perfect «oneness of all physical characteristic» is the *eigentone* of a body, its natural frequency, the «authoritative tone, which this whole emits», as Goethe so aptly characterized it, its «base-tone» (GOETHE 1963, 39: 208); or in English, where sound and ground resonate—the innermost ground or reason.

Can we not see a kind of liberation of sound stifled by solid matter or even congealed into solid matter and therefore silenced? A liberation coming from this «quivering of the body» (HEGEL 1986: 179) which was caused by an agitation—but not in its destruction or complete dissolution? (see NICKLAUS 1994: 153). A liberation through oscillating vibration, a swaying «double-movement» (GOETHE) with previously firm and rigid borders? The liberation of a tone that is now, as the soul trapped in matter, allowed again to begin to breathe as its natural vibration.

In considering the Arts from this perspective, we do not diminish or ignore the subject (matter), but are instead being led to an understanding of comprehensive contexts and the universality of this phenomenon through our intensive pre-occupation with the processes of oscillation. All true art strives to surmount the fixation on visible, material forms and borders, towards a more open and farther reaching understanding. In the visual arts, it may be most particularly impressionist paintings that provide examples of a liberated mood caused by physical boundaries becoming open, permeable and starting to oscillate. [Translator's Note: Here the author plays with the word *Stimmung*—'mood' which, in German, has the root 'voice'—*Stimme*, this word game can not be translated into English.]

«But how do I approach a beingness, that is not a dead identity but live existence, in which every border is truth and untruth simultaneously?» asks the philosopher Klaus HEINRICH (1964: 15). This question of borders is fundamental to each individual: is it a wall that excludes everything else or is it a surface at which to touch, a place for meeting and exchange?

«The more individualized something is—the greater the number of touching points with other individuals—the more fluctuating its border, its neighborhood.» (NOVALIS 1957, I: 470)

DOSTOYEVSKI describes man and even the whole world as someone trapped in the «stony wall» of a «deep basement» desperately struggling for new and open references, as a soul crying for «living life»—could this not be the inner unrest described above, this vibrating quiver, of which, for example, van Gogh's paintings are pervaded and touched?

The works of Teilhard de Chardins contain a story titled «The Picture» in which he describes in depth a special «border-experience» (TEILHARD DE CHARDINS 1966: 47ff.):

«It is definitely certain that I suddenly noticed they melted, when my glance wandered across the contours of the picture, they melted, but in a special way that is hard to describe. When I try to perceive the silhouette of the person Christ, He appears clearly outlined. But then, when I relax my effort to perceive, the aura of Christ, the fold of His robe, the rays of His hair, the flower of His flesh merged into one (but without completely disappearing). One could say, that the separating surface between Christ and the surrounding world morphed into a vibrating sheet in which all borders melted.

«First I noticed that the vibrating atmosphere surrounding Christ like a halo, was not limited to a thin film around him, but radiated into infinity. From time to time, something like phosphorescent strings passed by, that told of a permanent sparkling to the outermost spheres of matter—they drew a kind of net of veins or nerves, permeating through all life. The whole universe vibrated. And yet, when I tried to observe the objects one by one, I still found them always just as clearly drawn in their preserved individuality.»

To the extent that something is alive and is not solidified into a dead object, it oscillates, it pulsates and it sounds. Even «the sun sounds in old ways», as Goethe said in «Faustus I», and as modern astrophysics has been able to prove through precise measurements, the sun is pulsating and oscillating like a heart—the heart of our solar system—and that it even reveals the same basic principles of sound figures.

Figure 46 – The sun as a gigantic oscillating bell

«The energy created in the center of the sun is initially transported primarily by radiation to the outer shells through material eddies. Sound waves appear in the seething gases of these convection zones. These waves are virtually captured within this sphere, because at the suns surface, where the density drops off steeply, they are reflected back into the center [much like sound waves reflect back inward from the edges of the steel plates, creating the nodal wave patterns we've been examining. Ed.]. As the speed of sound increases with the depth [due to the incresed density, Ed.], the deeper part of the wave front moves at a higher speed than that at the surface, thus the wave is bent towards the top.... The whole mass of the star therefore oscillates like a gigantic bell. At any time there are regions that move inward (red) and outward (blue) (LANG 1997).

«The Sun, in ancient guise, competing

With brother spheres in rival song,

With thunder-march, his orb completing,

Moves his predestin'd course along.»

(GOETHE, Faustus I)

Vibrating Life

The similarities of structure, design and pattern of many types of Chladni sound figures with those structures, designs and patterns of natural phenomena, is quite surprising and suggests a certain kinship, or commonality of origin. It is not my intention to hastily contend a simplistic identity between these phenomena, but rather to conduct experiments to widen the view regarding fundamental processes shaping nature.

«I particularly like analogies as dependable teachers knowledgeable about the secrets of nature» (KEPLER, quoted by HAASE 1998: 28). Just as Johannes Kepler described his way of research and thinking in this way, it is in this same sense that we have to interpret the harmonic proportions that we can observe everywhere in nature, as a hint of the holistic character of the world, of a common harmonic creative principle affecting everything. «And so chaos points to a secret law, of a holy mystery.» With these words did Goethe attune the reader of his poem «Metamorphosis of a Plant» to his fundamental thoughts (GOETHE 1963, 9: 72). In his lectures on color he says: «With any phenomenon in nature, especially those that are important and noticeable, one should not stop, not attach oneself to it, not stick to it, and not view it as isolated. Instead one should look around at all of nature to see where we find something similar, something related; because only through compiling the related does an 'all-ness' develop bit by bit, one that expresses itself and requires no further explanation» (GOETHE 1980, I: 131).

The point is not a simple arranging next to each other, it is not the comparison of external similarities of something arisen, but it is the question and the search for the unified process of becoming and emerging. Hans Jenny too, in the same way, stressed this aspect as the central question and made it the foreground of his considerations in all his works.

«The relationship must not be analogous, but homologous—alike in character—if they really have something to do with each other. It is therefore

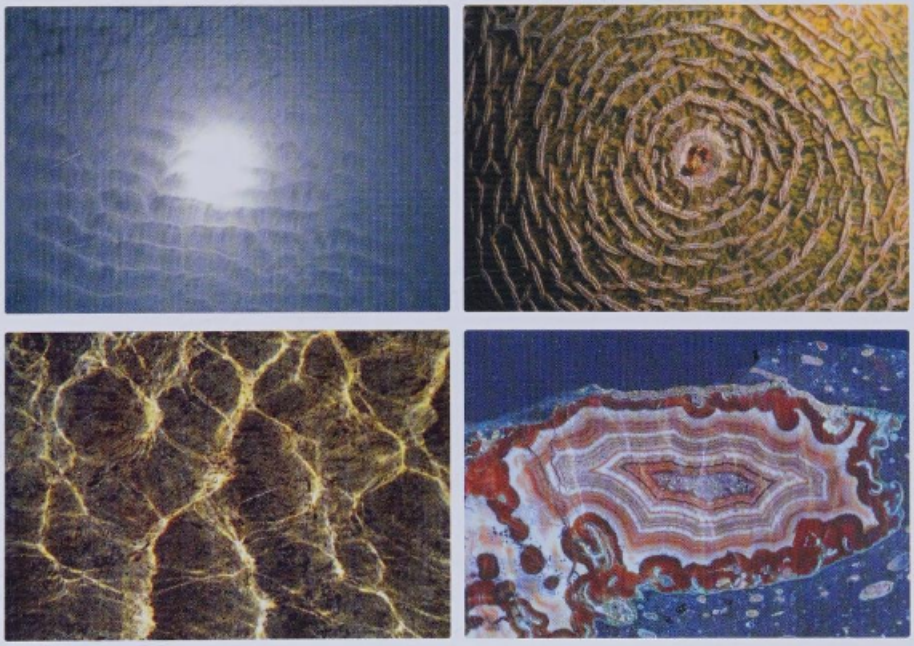


Figure 47 – Natural formations and structures revealing similarity of vibration: Cloud formation, a melon, water waves, agate cut.

important to observe in a realm of nature and let it speak itself, in this way to understand if it embodies processes of oscillation, or wave-phenomena.... The question is if there is commonness, uniformity of an essential type.» (JENNY 1972: 133) «Uniformity of an essential type» can only mean that even with great variations in the process itself—physical-technologically created waves in solid and liquid substances under very restricted conditions on the one hand, and biological life-processes in a natural environment on the other—that the rhythmical-periodic «wave effects» (ibid: 15), observed in both areas, suggest the conclusion that nature creates and affects its forms and shapes through alive-creative, rhythmic-oscillating, pulsating processes.

Hans Jenny repeatedly referenced the «signature of periodicity and rhythmicity» (ibid: 167) and its universal importance. «Should it turn out that objects have a periodic appearance even in the widest sense, then periodicity would be a common aspect of the world. Being periodic, as a repetition of a phase-sequence, would then be an elementary and universal type of phenomenon of the world» (JENNY 1962: 36).

To open our eyes to this «pan-periodic character of the world» (JENNY 1967: 13) he offered numerous examples found throughout all realms of nature, like the «system of circulation and breathing» (ibid: 10), the structure of the nervous system and the impulse-character of all nerve-processes; the «serial element», the «repeating structures» and net-like structures in botany (ibid: 10); the «periodic rhythmic style» as the «dominating factor» in the animal world. «Remember the metamerism in the different classes of animals. Many worms, arthropods and vertebrates gain their own imprint through these laws» (ibid: 10), and this organizational principle starts to manifest very early in the «form of primal segments and vertebrae» (JENNY 1967: 10) during the embryonic development.

From «muscle-tone» (ibid: 14), to the «flight of an insect» (JENNY 1962: 38), from the grid-structure of crystals (ibid: 38), to the oscillation-states of atoms and their electron clouds (JENNY 1972: 163), the wave-character of warmth, light, radiation and gravity (JENNY 1962: 39) up to the physics of the sun and other macro-cosmic events (JENNY 1967: 12)—wherever the attentive observer turns, everywhere is unveiled to him, through the

Figure 48 – (From HAUFF, 1981: 42)

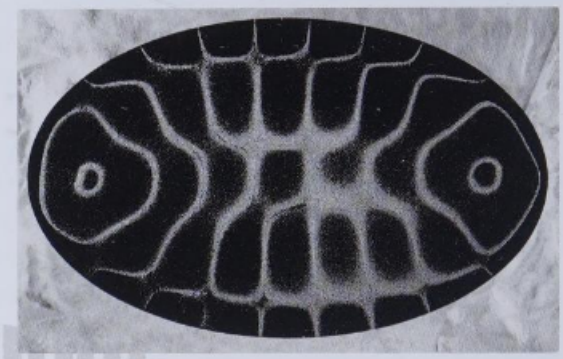


FIGURE 49 – BEING AND NOTHING
—SOMETHING AND EMPTYNESS

On an oscillating plate the bright figures correspond to the node lines. This is where the sand, the material, is gathered, comes to rest, densifies and creates a forms a 'something'. Similarly the black areas in between correspond to the vibrating fields. They don't allow the sand to pause in their pulsation, nothing rests. In this way the principle of movement is revealed as the immaterial emptiness, the massless nothing, the 'void' which is free of matter. Following similar consideration we can learn from a skeleton how the firm substance of the bones offers stability. But it is only the empty space, the non-substantial nothing in between, which enables the living creature to move.

«Thirty spokes meet the hub, but the emptiness between them
creates the essence of the wheel;
Pots emerge from clay, but the emptiness within
creates the essence of the pot.
Walls with doors and windows constitute the house,
but the emptiness within creates the essence of a house.

Basically:

The material brings usefulness,
The immaterial brings essence.»
LAO TZE

waveform and periodic appearance of nature, the elementary processes of rhythmic form-giving; visible through the polar effects of contraction and expansion, compression and extension, solidifying and liquefying, through systole and diastole.

Is not Goethe's «Polarity and Augmentation» (GOETHE 1963, 39: 174), the mysterious «How of all Becoming and Emerging»; this «Double-Movement», that can only be perceived and become possible through its swinging-pulsation and oscillation?

«Basic character of the living unit: to divide, to unite, to surrender itself into the general, to persist in the specialized, to change, to particularize, and as the alive might display itself in a thousand conditions, to step forward and to disappear, to solidify and to melt, to congeal and to flow, to expand and to contract.» (GOETHE 1980, I: 267)

Current biological research suggests a very similar perception of life in which the «organism is no longer simply a machine of self-preservation», but a living being that «just like art, represents value by itself», quoting biologist B. GOODWIN (1997: 16), and as such, is itself, a continually developing perception of life. «Life exists on the perimeter of chaos, oscillating between chaos and order in the permanent search for emerging order» (ibid: 276).

«For complex non-linear dynamic systems of large networks of interacting elements» as for example a living organism, «there exists an attractor (in the sense of a desirable condition), which lies between a region of chaotic behavior and a region of 'frozen' regimen, in which hardly any spontaneity occurs.

Each such system, whether it be a not yet matured organism, a brain, an insect colony or an ecosystem, converges towards the border of chaos. When it drifts into the chaotic regime it will again come out by itself; if it ventures too far into the order regime and freezes it will again 'thaw' by itself to regain dynamic agility, which is characterized by a great but unstable order» (ibid: 277). This principle echoes a maxim of Heraclitus—*en antió dromó*, «on opposite course» which means that upon reaching the extreme of one polarity the opposite polarity starts to take effect and thus causes the reversal. This is the fundamental principle of all oscillation.

What does Goethe say in «Metamorphosis» versus «Urge for Specification»? «The metamorphosis…leads into the shapeless…. It is like a *vis centrifuga* and would be lost in infinity, had it not been given a counterbalance; I mean the urge for specification, the tough inertia of that which has already become real. A *vis centripetal*, which, in its most basic foundation, cannot be touched by anything external» (GOETHE 1963, 39: 143).

It can be observed that over these past several years the subject of morphogenesis, the shaping and pattern-forming of the living organism, has gotten more and more attention. It has also become clear that the present approach in biology, which attempts to construct a comprehensive understanding of an organism atomistically, by adding together the smallest parts to arrive at the organism as a whole, has reached its limits and needs an alternative.

There are approaches in biological research that try to understand the process of pattern formation through self-organizing, complex, chemical reactions. Extrapolating from the texts of Rudyard Kipling, «How the Leopard got its spots», the biologist J. MURRAY (1988: 88ff) tried to explain the formation of patterns in animal skins through a self-regulating process which altered the development of pigment activating and inhibiting substances. He also draws upon the theories of the mathematician A. Turing and the «Turing-Patterns», named after him (see DEUTSCH 1994: 29ff, 150, 227, 247).

In this context the famous «Belousov-Zhabotinskii Reaction» (DEUTSCH 1994: 232; see STEWART 1998) is always mentioned, in which «local disturbances» in an «excitable medium» lead to an «instability», which might eventually cause a «chemical oscillation» through which then «excited states» spread as «activity waves» (DEUTSCH 1994: 227ff., see MEINHARDT 1997).

Figure 59 – It is still an unanswered question in biology today, how the leopard gets the pattern of its fur, the characteristic signature of his type. Compare this with the pattern of the Chladni Sound Figures (below) at 10,101 Hertz.

Different authors explained these pattern-forming processes in varying ways, yet their choices clearly demonstrate the central role of periodic wave-processes between two polar principles, forces or states, in this case, concentration and dilution. First, there is the activating phase, then the arresting of accelerated movement with a gradual deceleration to a resting state which is associated with increasingly dense concentration, and finally the diluting phase. Also in the formation of fractal structures it is the repeating «iteration» of one base form or matrix—in other words the principle of «periodicity» (H. JENNY)—that allows complex forms to develop according to the principle of «self-similarity».

Most revealing for our line of questioning, is the primary importance of the «excitability» of a substance, which immediately affects the aspect of its willingness to resonate, or the relevance of the aspect of a «disturbance» which inevitably leads to the phenomenon of «vibration»[6].

B. GOODWIN (1997: 297) emphasizes in his struggle for a «science of qualities» however, «that the molecular composition is not sufficient to explain features such as the dynamic patterns of excitable media or the forms of organisms evolving from those patterns»; and he continues: «this quantitative research procures very important insights about the dynamic character of an organism on the molecular level, but they are not sufficient to describe the rhythms and spatial patterns, that occur during the evolution of a living being and that put forth form and behavior» (ibid: 300).

Starting from a more mathematical approach Ian STEWART (1998: 176) formulates the problem as follows: «We require an effective mathematical theory of form; therefore I call my dream *Morphomatics*. Unfortunately many areas of science currently steer in the opposite direction. The DNA

[6] How the phenomenon of processes pertaining to oscillations is increasingly coming into the center of attention, is also evident in the book by Friedrich CRAMER entitled, «Symphony of the Living: an attempt of a General Resonance Theory», in which, for example, he describes the «segments of the body of an insect» as a «chemical standing wave» created by «resonance» (CRAMER 1998: 124. See the chapter «Standing Waves» in this book, Page 72.)

sequence for example, is often seen as the only answer to the question of the patterns and forms in organisms. But the current theories about biological development do not adequately explain why the organic and inorganic worlds have so many patterns in common.» Stewart continues: «We want to know, why this is so, and this means that we have to develop a new kind of mathematics, one that treats patterns as patterns and not just as accidental consequences of interactions occurring on a very minute scale.... We will never understand the growing of a tree or the dunes in the desert, if we continue to try to reduce the freedom of nature to limiting numeric schemata» (ibid: 175).

Ian Stewart's thoughts culminate as follows: «The patterns of nature are «emergent phenomena» (emerging from the process of nature herself, as a new quality). They surface from the ocean of complexity just as Botticelli's Venus emerged from the shell—unannounced and transcending their own origin. These patterns are not a direct consequence of the deep simplicity of the natural laws because these laws must be considered to act at a different level.

«They are, without a doubt, indirect consequences of the deep simplicity of nature» (ibid: 174), but might one not better say that they are «consequences of the deep Unity of nature?» Are the shapes and patterns occurring in nature not, as Ian STEWART (ibid: 106) says, «fragments of the grandiose universal symmetries» resounding in resonance, therefore individualizations of the original unity and uniformity of the whole, exceptionally mirrored in the particular forms, patterns and shapes of a creature?

Are animals really explainable, or even understandable, only through the lens of evolutionary functionality? Are their so-often striking patterns really nothing more than random effects which happen to become optimal camouflage? Rather isn't just the design of the appearance alone, as the biologist A. PORTMAN (1965: 152, 233) once said, «an elementary feature of life» and not just an artifact of the struggle for survival, for feeding, for reproduction etc.? The evolution of the animal's shape might be better conceived of as a «composition» (ibid: 174), a «becoming form for their own inner purpose, the profiling of a...being» (ibid: 234).

It would be an outward expression of the «realization of a special relationship with the world» and would demonstrate how an 'Inner' meets the external world and at the same time demands from us, that «the visible appearance of the living must be observed in the widest context and experienced as something inconceivable, as a Beingness grounded in the secret of reality» (ibid: 236).

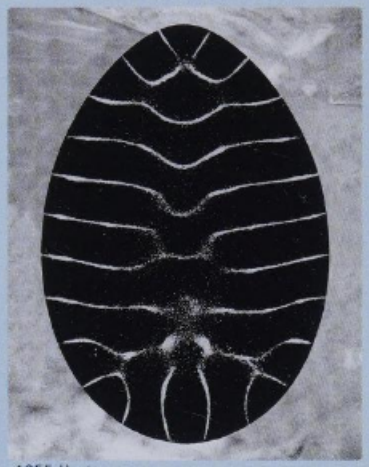
Every animal body is able to do certain things in a unique and specific fashion, while unable to do other things. It expresses something, a certain quality or character of spirit; it demonstrates, intends and means something. Every body-form relates to a life-form: The living form is an expression of life itself, a gesture, a physiognomy of a particular Being-In-The-World. Every animal does something in or to the world in its course of life, of which we may have no inkling, and does so in «holy seriousness» (R.M. RILKE). It represents a moment of evolution of life, while at the same time, it is developing the whole through the very fact that it leads a life.

Do the different animals perhaps mirror and design a specific aspect, a theme, a history of the universe through their form of existence? Do they perhaps internalize a particular world-view and reveal through their form something unique, an aspect of its spiritual content and mental reason, a living picture so to speak? Are they the answer, alive and taken form, to the theme of the world to which they are attuned in perfect resonance, with which they agree in perfect harmony?

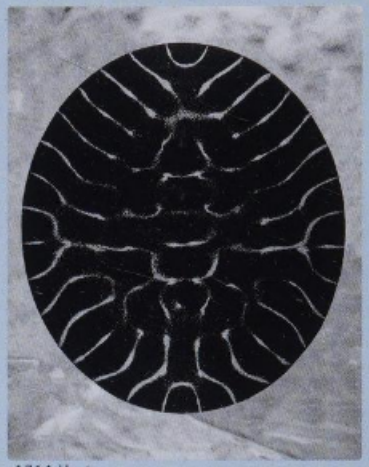
«Animals are hieroglyphs born out of a cosmic language; they are also the seals, pointing to the universe and its reflections.» (JENNY, Tierlandschaften [Animal Landscapes] 1992: 89)

Feathers (from PORTMAN 1965).

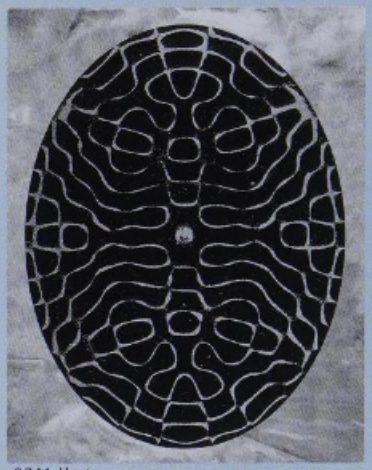
1322 Hertz.



1355 Hertz.



1714 Hertz.

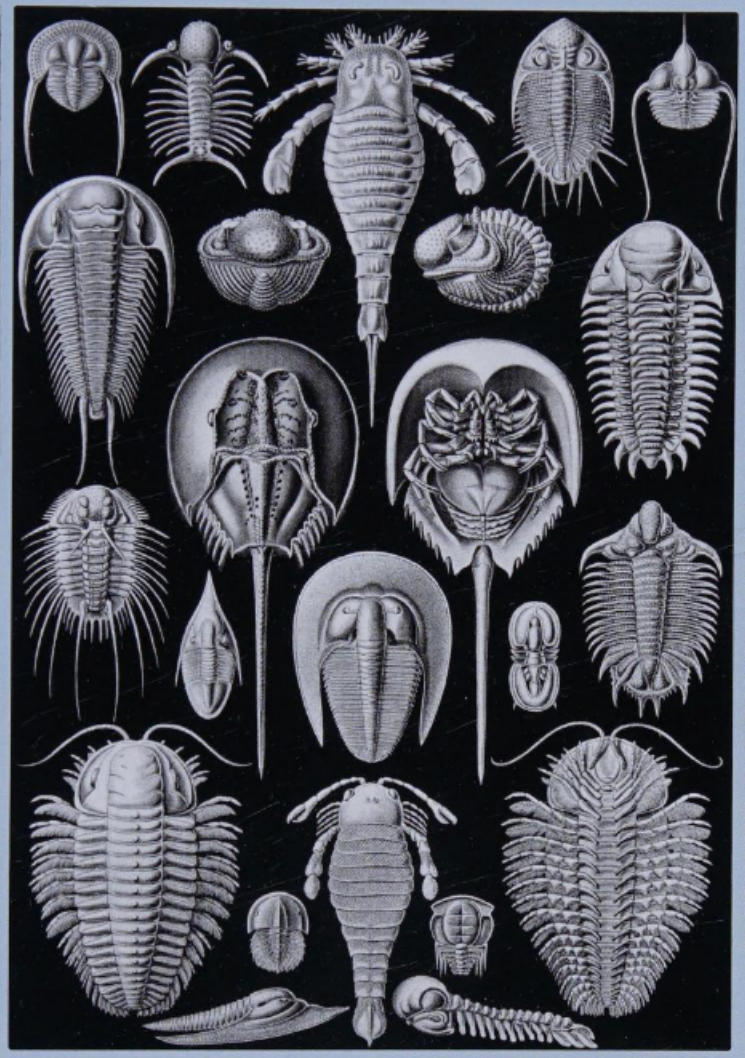


8741 Hertz.

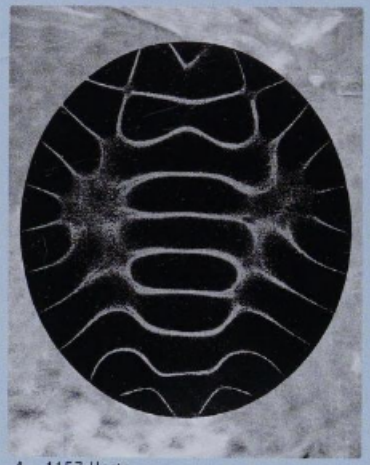
Figure 60 – The pattern on a zebra's hide—is it only the result of a random mutation or the sensible expression of a creature that wishes to present itself and communicate with the world? In comparison, Chladni Sound Figures show unique patterns of resonance for each individual plate.

1 9438 Hertz.

2 7010 Hertz.

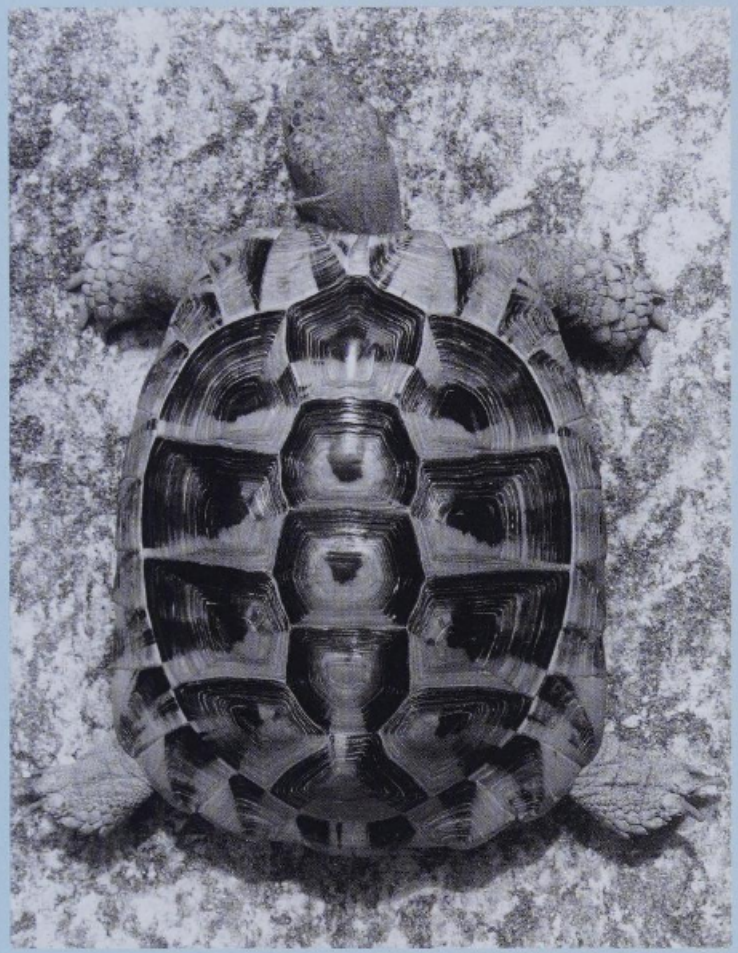


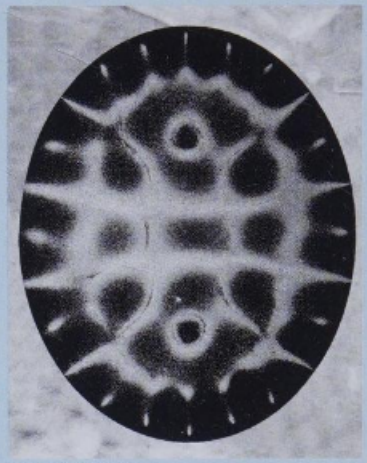
3 1122 Hertz.



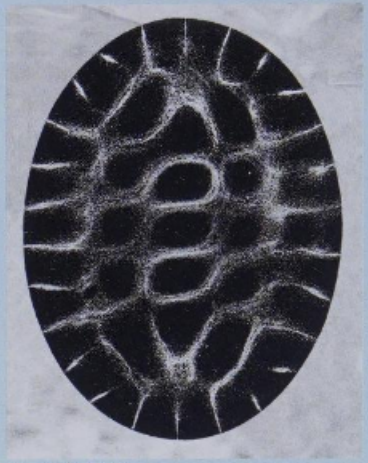
4 1157 Hertz.

Figure 61 – One typical structure observed in nature is that of repeating segmentation, such as the nodes of plants, the organization of an animal body into many segments as in worms, the larvae of insects, or the vertebrate spine. The similarity between the oscillation patterns of sound figures and these natural shapes is astounding. The oscillation of the metal plates shown above was induced either in the middle (image 1), in both focal points (image 2) or at the outer edge (images 3, 4). The drawings in the middle come from Ernst Haeckel (HAECKEL 1974).



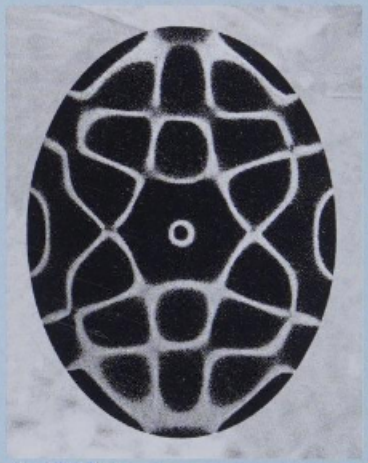


1 1021 Hertz.



2 2041 Hertz.

3 1088 Hertz.



4 1085 Hertz.

Figure 62 – Another unique example of the presence of regularly occurring «harmonic patterns» in the appearance of an animal, occurs in the surface of the shell of a turtle, which exhibits, in most species, a uniform structure. The heart-shaped middle part is divided into 13 fields and is surrounded by 24 or 25 plates. At specific frequencies, oscillating elliptical plates display Chladni sound figures which are very similar to the shell-structures of these animals. Clearly visible are: the rim with its 24 fields (image 1), the distinct delimited middle part with its five fields in a row (images 2, 3), a pentagon toward the front (image 3) and a hexagon in the middle (image 4).

In long gone, far away days
I carried the earth
through the wide ocean of sounds.
If now the children ask—
I myself can't say any more,
It is many thousands of years ago.

But later I became small and manifold
And lived on earth in many places
In swamp, on land and in the ocean.
Many a man found my empty shell
And thought nothing of it.
From the realm of the gods
Resourceful Hermes came along.

Curiously, he holds it to his ear, to listen—
And hears the world's tones roar.
So he thought of something:
Cow horns he stuck to it, bent,
strings he strung to it
making it into a lyre.

«But what did he want with a lyre?»—
Oh child, a gift it was to Apollo,
Who sang with it the song of the sun.
Descended he then from heaven, choosing bards,
Teaching them the harp,
To endow order, quiet and peace.

Allowed to teach the worldly sounds,
Honor was mine, with many others,
Where strings sound bright and clear.
But man has forgotten everything—
And has left me to eat lettuce and worms
And now no one remembers what it was that I began.

(Wolfgang SCHICKLER 1945)

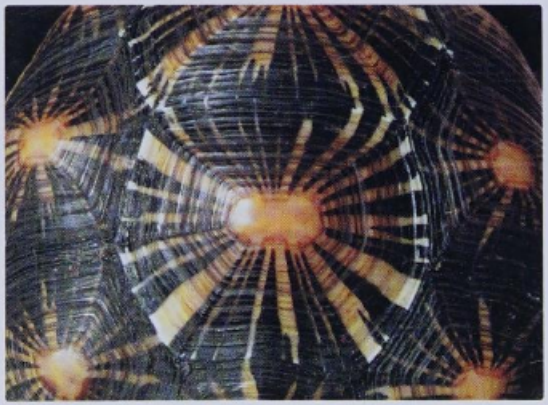


Figure 63 – Rayed Tortoise from Madagascar.

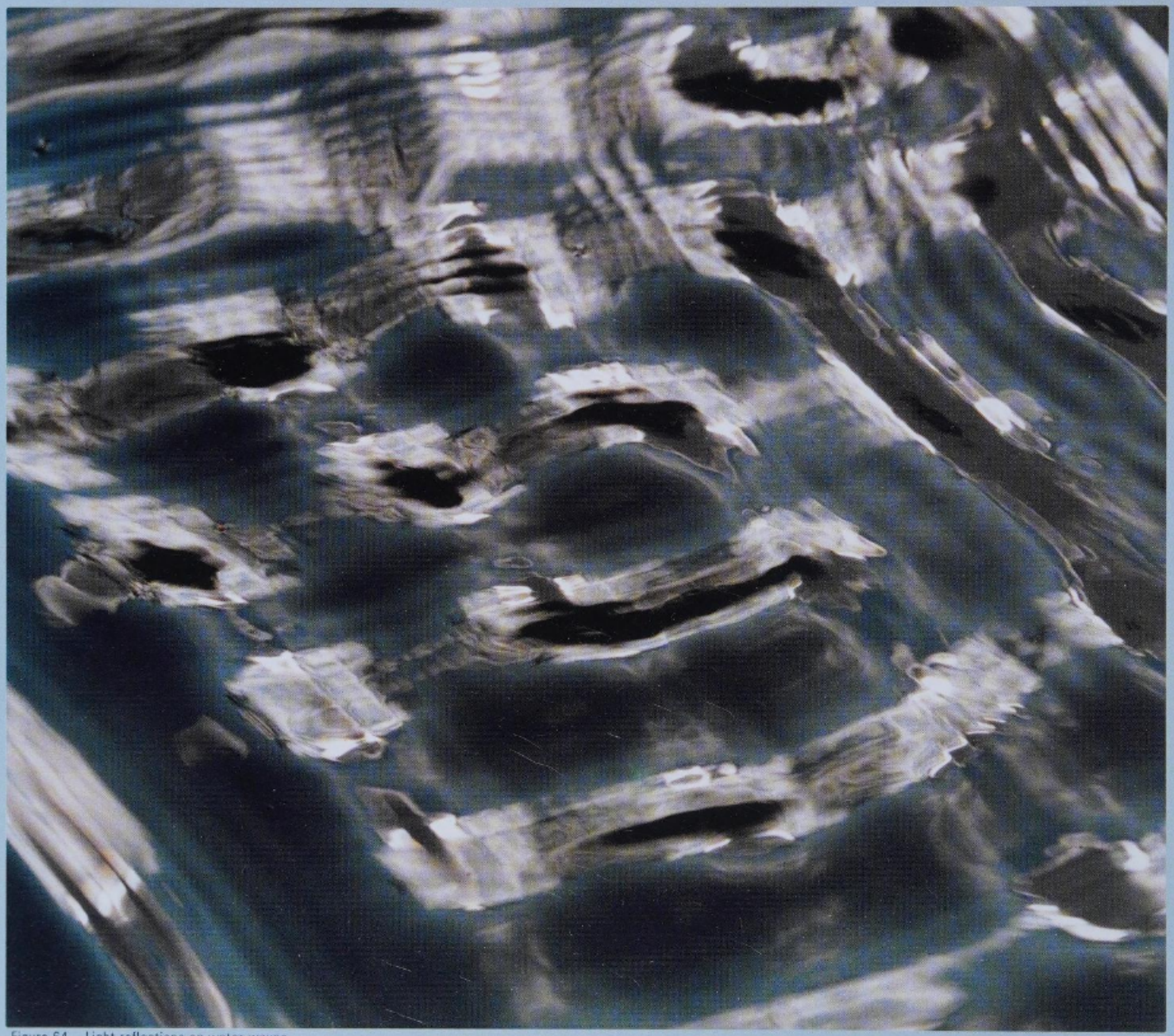


Figure 64 – Light reflections on water waves.

«Water connects what was once separate

urging it into a conscious being,

melding into all an element

of liquid heaven.»

(Rainer Maria RILKE, Abandoned On the Mountains of the Heart, 1976a: 157)

One of the essential aspects of the phenomenon of 'Life' is the incessant swinging back and forth between two extremes in an attempt to mediate, balance and harmonize. At one extreme, we have the losing of oneself through a kind of dissolution, and at the other, a solidifying concentration into a firmer order. On this living planet, the element 'water' best portrays this oscillating dynamic between chaos and order. It swings back and forth perpetually changing between its diverse states of condensation, evaporation into the air, streaming and flowing in its liquid state, and freezing as ice; unifying all of the different regions of our planet in one perpetual circular flow.

[7] Anomaly of Water, Table after a script by Wolfgang Ludwig:

	Actual (cluster)	Nominal (single molecule)
Critical point	374 °C	60 °C
Boiling point	100 °C	-80 °C
Melting point	0 °C	-100 °C
Vaporization heat	9.7 kcal/mol	4.0 kcal/mol
Specific heat	18 cal/degree and mol	9 cal/degree and mol
Vaporization entropy	26 cal/deg and mol	19 cal/deg and mol
Specific weight	1 g/ml at 4 °C	0.5 g/ml decreasing with temp
Mol Volume	18 ml/mol	40 ml/mol
Volume change freezing	+ 1.62 ml/mol	-1.5 ml/mol
Viscosity	1.7 c-poise	0.2 c-poise
Surface tension	75 dyn/cm	7 dyn/cm

The well-known phenomenon of the 'anomaly of water'[7] demonstrates that the substance 'water' exhibits features, that do not seem to fit the normal physical-chemical order. It can therefore be seen as an organic substance which is connected to all life processes based on these characteristics.

Throughout the ages, humanity has revered this element as a primal source of the creation of the world and of life processes, perhaps because of its universality. On the one hand, water is shapeless in its resting liquid state, but on the other hand it has a nearly limitless multitude of forms, from the six-sided snow crystal to its waving, flowing, whirling movement, from the shapes of clouds to the miraculous spherical shape of a water droplet. (cmp. DETEL in BÖHME 1988: 43ff.)

«For good reason have the ancient sages searched for the fountain of all things in water, and verily they spoke of a higher water than the ocean or spring water. In this, only the primordial liquidness is revealed, just as it shows itself in liquid metal, and therefore man only wants to divinely revere it. How few have immersed themselves into the secrets of liquidness and many a man never experienced in his drunken soul this inkling of the highest pleasure of life. Through thirst the world soul is revealed, this immense longing for deliquescence. The inebriated one feels only too well the unearthly bliss of this liquidness, and in the end, all those comfortable sensations within us are diverse deliquescence, impulses of those primal waters within us.» (NOVALIS 1968: 133)

Oscillating Water Drops

As far as we know, it was Hans Jenny who first had the idea to apply Chladni's approach to liquid media, thus revealing a nearly inexhaustible multitude of Cymatic phenomena. We shall start our examination of processes of formation caused by oscillation in the sensitive medium of water, with the smallest oscillating unit—the water drop. (JENNY 1972: 73ff., 110ff.)

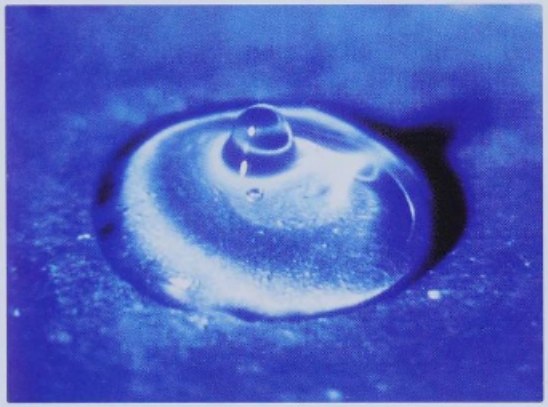
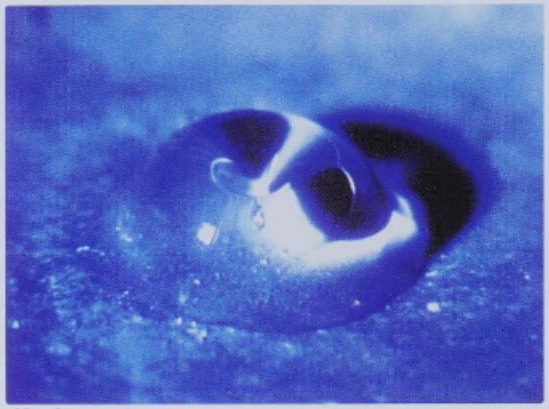


Figure 65 – 1



65 – 2

Excited through a frequency generator and a special sound transducer, a flat or slightly cambered carrier plate is set into vertical oscillation between 40 and 120 Hertz. On the carrier plate we have placed from one to six drops of water, which in turn begin to oscillate in characteristic ways, depending on the amplitude (volume) and the frequency (pitch) of the impinging oscillation. This results in different form-building processes which, although they move much too quickly to be perceived by the naked eye, can be made visible with the help of an adjustable strobe light and then be viewed as video or still images.

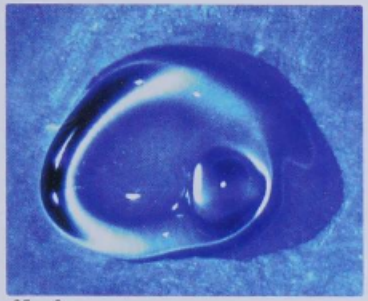
In this way, the following basic processes of formation can be observed in rhythmic phases of pulsation:

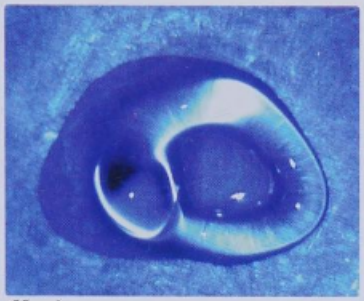
1. At very low amplitudes, two opposing phases may be observed—either a polar dome, or a depression, develops in the middle of the drop. The dome develops as the carrier plate moves downward and the depression as it moves upward. At the rim of the drop no form changes occur (Figure 65-1, 2). We can sometimes observe whirling and streaming movements in the substance of the water as evidenced by the motion of tiny air bubbles within the drop. Interestingly, these bubbles move in different directions than the outer motion of the overall form.

2. Depending on the amount of water, the amplitude and the frequency, a bipolar shape can be formed where the drop extends a bit in length. If there is a dome at the one pole then at the other pole a depression will develop; with both forms swinging back and forth like a pendulum (Figure 65-3, 4); Figure 65-5 shows the simultaneous overlay of both events so that two domes appear.

3. As the amplitude is increased within a constant volume of water, a new shape begins to form at the outer rim of the drop in addition to the alternating formation of dome and depression. Within very narrow, specific, frequency ranges, regular, rhythmic oscillations of the water drop develop. These are whole-numbered, structured geometric figures which Jenny called 'harmonic patterns.' Oscillating shapes emerge with three, four, five, six, seven and up to 10 and more distinct elements (Figures 65-6, 7, 8–15).

Characteristic of all these processes is a phase shift or reversal. If, for example, during the first downward movement of the plate, a pentagon is formed with the perimeter raised up and a dome in the middle, then during the following downward movement the same shape will form but with the perimeter moving downward with a depression in the middle. At the third downward movement the initial shape develops once again with the perimeter raised up. A complete run through the shapes thus requires two passes through the oscillation phases. Clear oscillating figures do not occur at all frequencies. As we slowly ascend through the frequency range, we find many ranges of frequencies where there are only completely unstructured, chaotic movements.


65 – 3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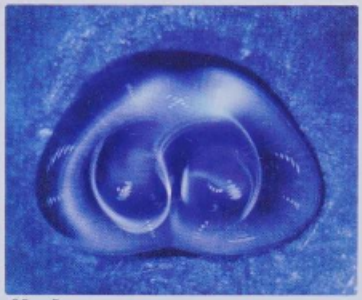
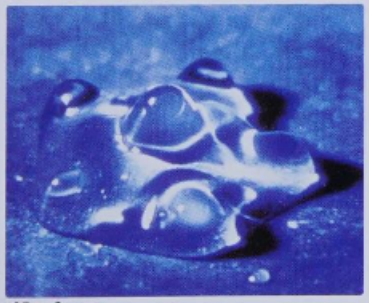

65 – 5

4. When observing this formative processes at an angle from above (Figure 65-6) or from the side (Figure 65-16–18), we notice how much the domes are arching, extending beyond the equilibrium of the drop at the outer edges and especially in the middle. This progression of images clearly shows how the water moves from the middle to the rim, condensing there into domes and then—similar to a wave in the surf—rolling back under to gather again in the middle. At higher amplitudes the center dome can taper so much that eventually small droplets detach and spurt out like in a fountain (Figure 65-19, 20).

5. Despite the multitude of experiments performed, only one single time–and so far we have not been able to repeat this–did, what started out as a totally irregular oscillating mass of water, stretch out in length and take on a form, immediately reminiscent of the segmented body of invertebrates, or the structure of the spine (Figure 65-21). [Ed. note: Jenny created a similar, segmented, 'vermicular' form by using a more viscous paste. See Cymatics, 2001, P. 119 Fig. #153.]

In all these observed phenomenon one can spectacularly experience how water responds to the purely mechanical up and down movements of the carrier plate with rhythmic oscillating movements and shape formation. The strictly regular beat of impulses is not just simply repeated, but constantly morphed. The water allows something new to emerge: this forming-rhythmic movement that more closely resembles organic movement, a living pulsating heart rather than simply shaken inert or 'dead' substance.

From the perspective of physics, it is the interaction of the surface tension that pulls the water into a sphere, and the up and down movement of the plate creating 'push and pull' forces acting upon the mass of water, that is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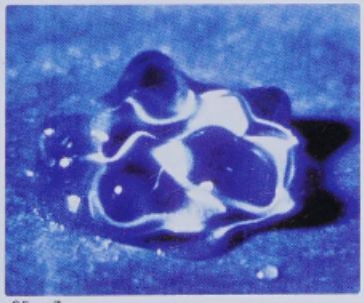
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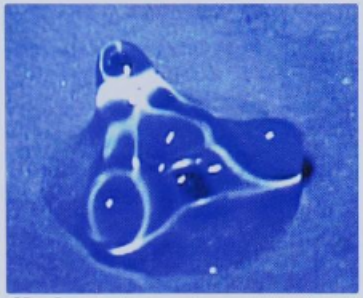
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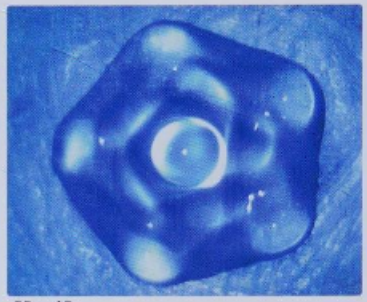
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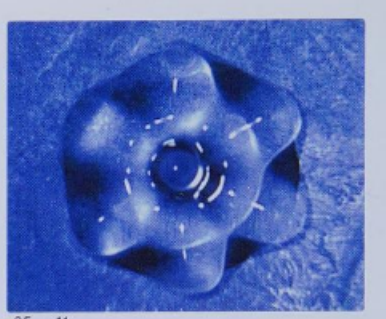
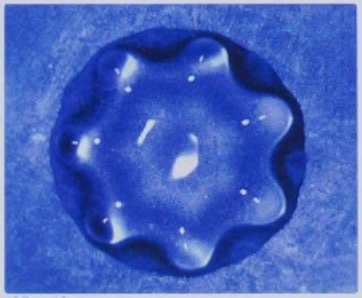
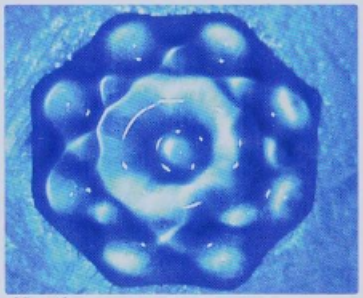

65 – 11


65 – 12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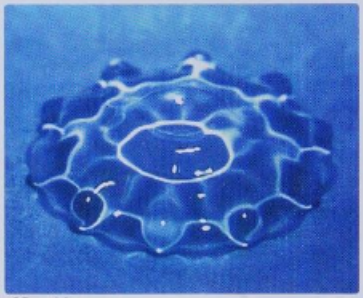
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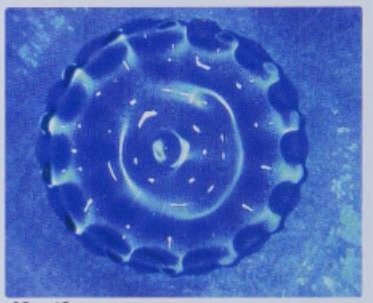
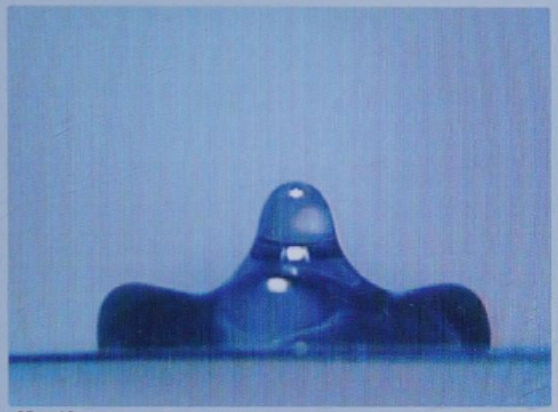

65 – 15

responsible for the processes of formation. It is precisely at the moment of balance between the two polar forces, where the pushing force is already acting and the contracting surface tension can no longer hold the water together, that the form-building occurs. In the smallest drops, when the amount of water is below a critical limit, the surface tension prevails so that despite the impulses acting on the drop, it remains spherical and does not experience changes in shape.

With otherwise constant conditions (amount of water, temperature, type of water, etc.) only the pitch (frequency) governs the specific number of nodes of the oscillating form. But the slightest change in the ancillary conditions changes the formation immediately and may even collapse it. Therefore there is no definite relationship, independent of all other factors, between a specific frequency and the node order of the figure. This means that a frequency of, for example, 65 Hertz does not always create a pentagonal oscillation figure in all media. As for Chladni sound figures, it is also true here that oscillation forms prove to be the result of a 'debate,' of a 'dialogue' between the external exciting oscillation and the inner conditions of the excited medium.

Still photos of the primordial shapes appearing in a small oscillating drop of water reveal the most fascinating structural forms, but it is only when one observes the dynamic aspect (for example through video imagery) that the cryptic language of life directly appears as a primordial phenomenon; lifting and lowering, dissolution and order, expansion and contraction, the «principle of gushing and sucking» (SCHWENK 1962: 60), the pulsation of the 'double movement' of systole and diastole.



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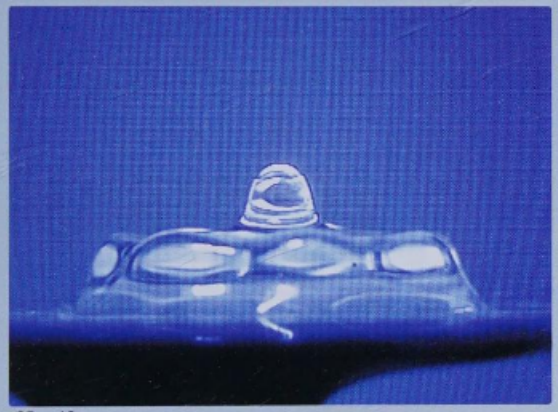
65 – 17



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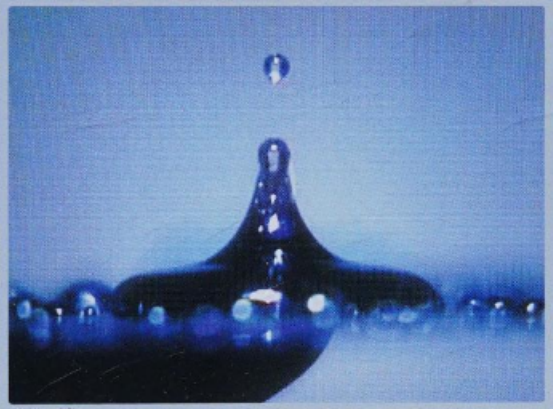


65 – 19

65 – 20

65 – 21: This unusually shaped oscillating water drop reflects a great similarity to organic life forms.

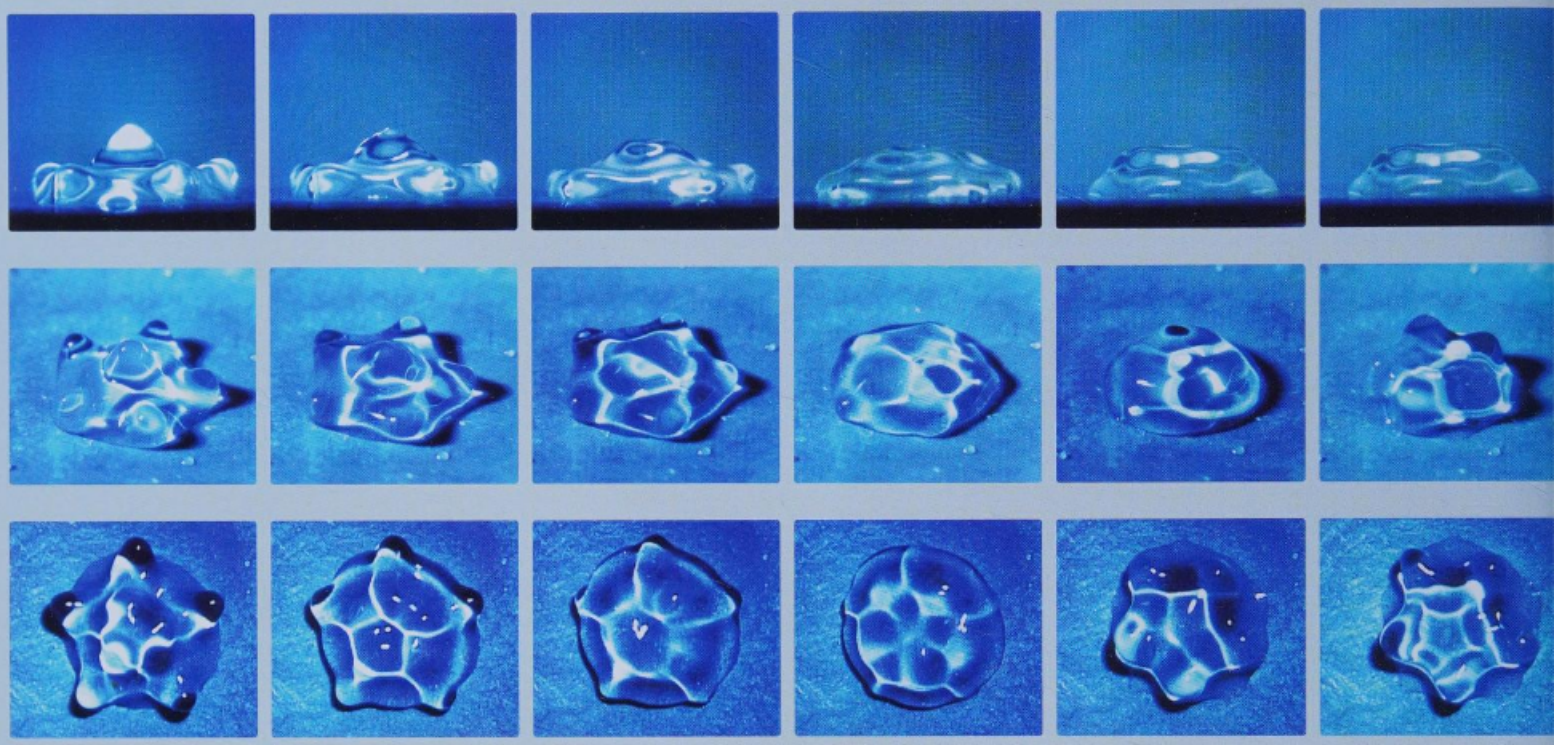


Figure 66 – This sequence shows 12 images of a full phase sweep of an oscillating water droplet, portraying one complete cycle of its undulating motion, viewed from three different perspectives. Top row from the side; Middle row from the top with a slight inclination; Bottom row, sraight down from above.

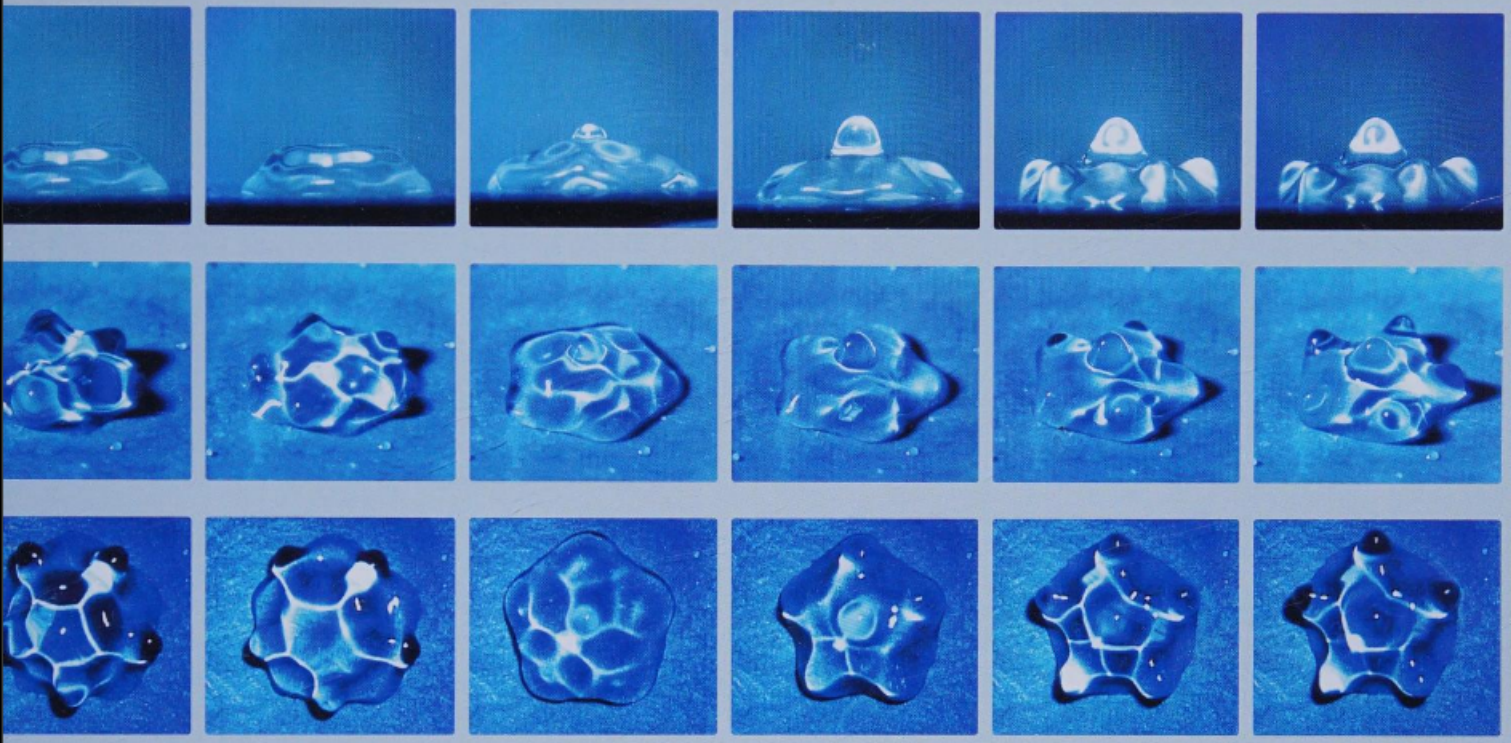


Figure 67 – Shapes of an oscillating drop of mercury. Since mercury has less adhesion to the surface upon which it is placed its shapes are more spherical and more pronounced.

Standing Waves

«Grammar. Not only man speaks – the universe speaks – everything speaks – innumerable languages. Science of signatures.» (Novalis, Fragments I, 1957: 149)

When two rigid bodies impact each other at one point in space, their impulses of movement disturb or even overpower one another, and these bodies are deformed or even destroyed. In the fluid medium of water however, the impulses of these different wave movements can overlay and interpenetrate each other.

In his book «Sensitive Chaos» (1962: 26ff) Theodore SCHWENK repeatedly points out this basic action: «In the same space there can therefore be only one object, but many, even polymorphic movements. This is an important principle through which space has been structured in obedience to universal laws. Movement thus shows itself to be independent of space but appears within it as an ordering principle.»

This universal principle is an important prerequisite for the formation of standing waves. If a water surface is set into motion by irregular impulses—for example through the shaking of a water glass—or if several waves are superimposed, perhaps through reflections of a wave at a shore wall, an unordered surging of different waves develops that leaves the viewer with an impression of unrest and chaos. But if a container is set to oscillate through a regular, consistent impulse—like a sine wave of constant frequency—a wave movement will develop with a definite and constant wavelength.

If the wavelength coincides with the diameter of the container, then the waves moving towards the rim of the container will superimpose upon the waves reflecting back. This happens in such harmonious ways that the nodes of both waves repeatedly meet at the same location. In such a case where the movement impulses do not disturb and irritate each other, a stable structure can develop. The observer gets the impression that the pattern is not moving, rather that it 'stands' in equilibrium—and all this in the midst of intense vibration and movement.

A very nice example of a 'standing wave' is shown in the image to the right. A square container with a side length of 8 cm (3 ¼ inch) and a water depth of 8 mm (one third of an inch) has been set in oscillation by a tone with a frequency of 595 Hertz. As all the factors match [the wavelength coincides with the diameter of the container], the waves reflected off the four sides interpenetrate each other in the manner described above, and this cross-shaped form, composed of water waves, can develop. Even when viewed in motion, this wave image appears nearly stationary, creating the impression of something solid.

The entire sample pulsates, oscillating back and forth and up and down. The substance, 'water,' streams through and through, and despite this constant movement, clean and orderly, quiescent patterns form at distinct frequencies. We can say that 'rest of a higher order' evolves out of the center of a dynamic oscillation—a rest founded in movement and not in the inertia of resting masses, or energy in motionless persistent states.

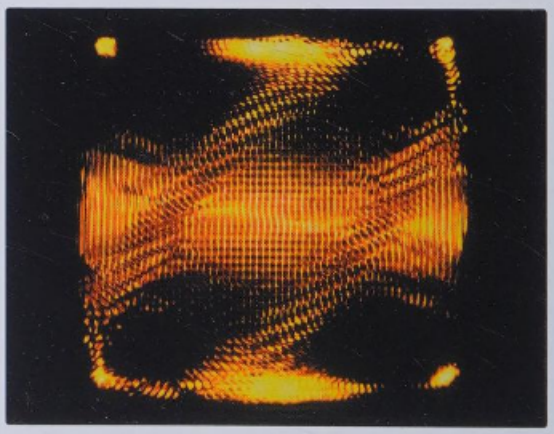
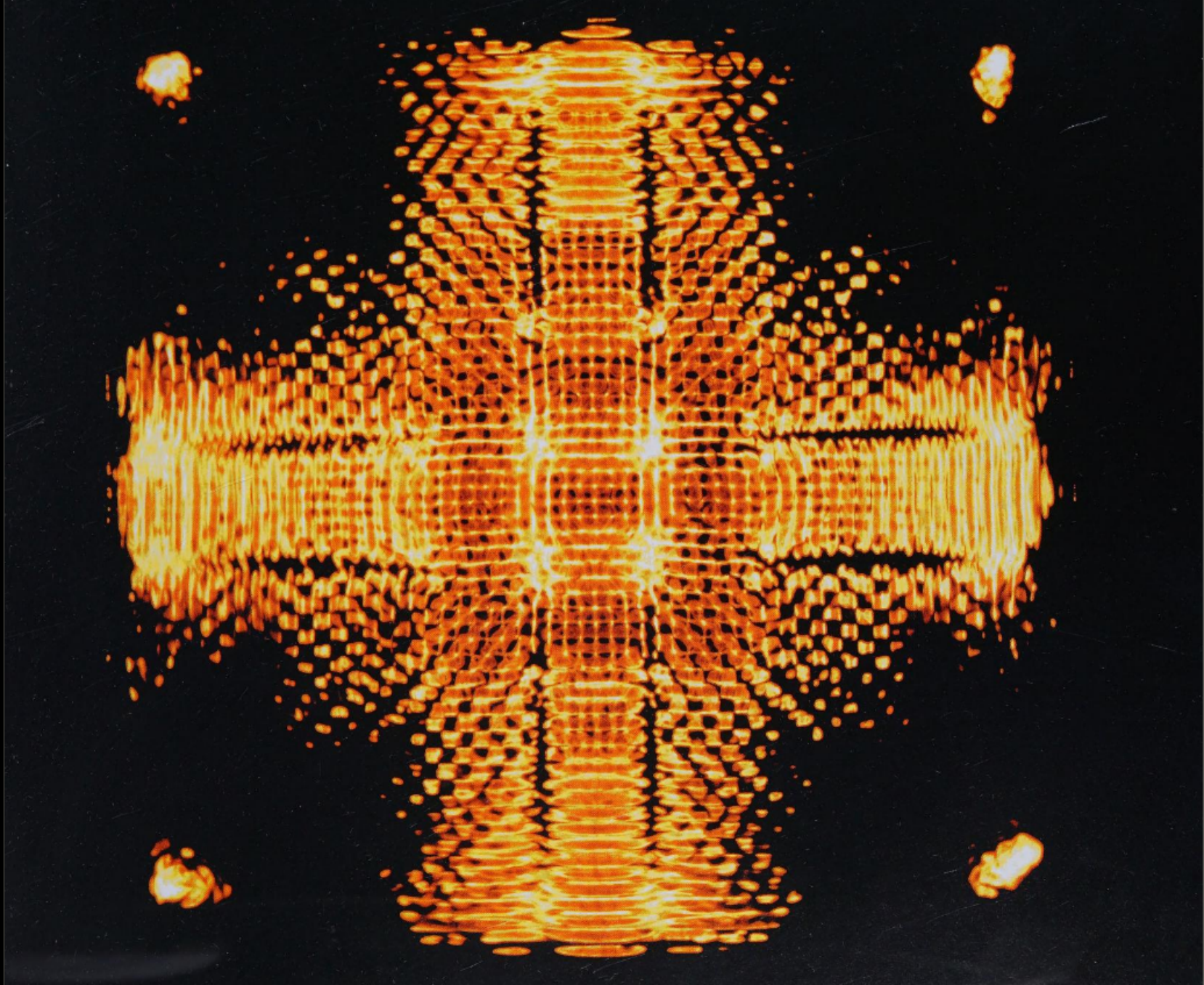


Figure 69 – A developing 'standing wave.'

Figure 68 – Right: Fully developed criss-cross 'standing wave' 595 Hertz, in square container.



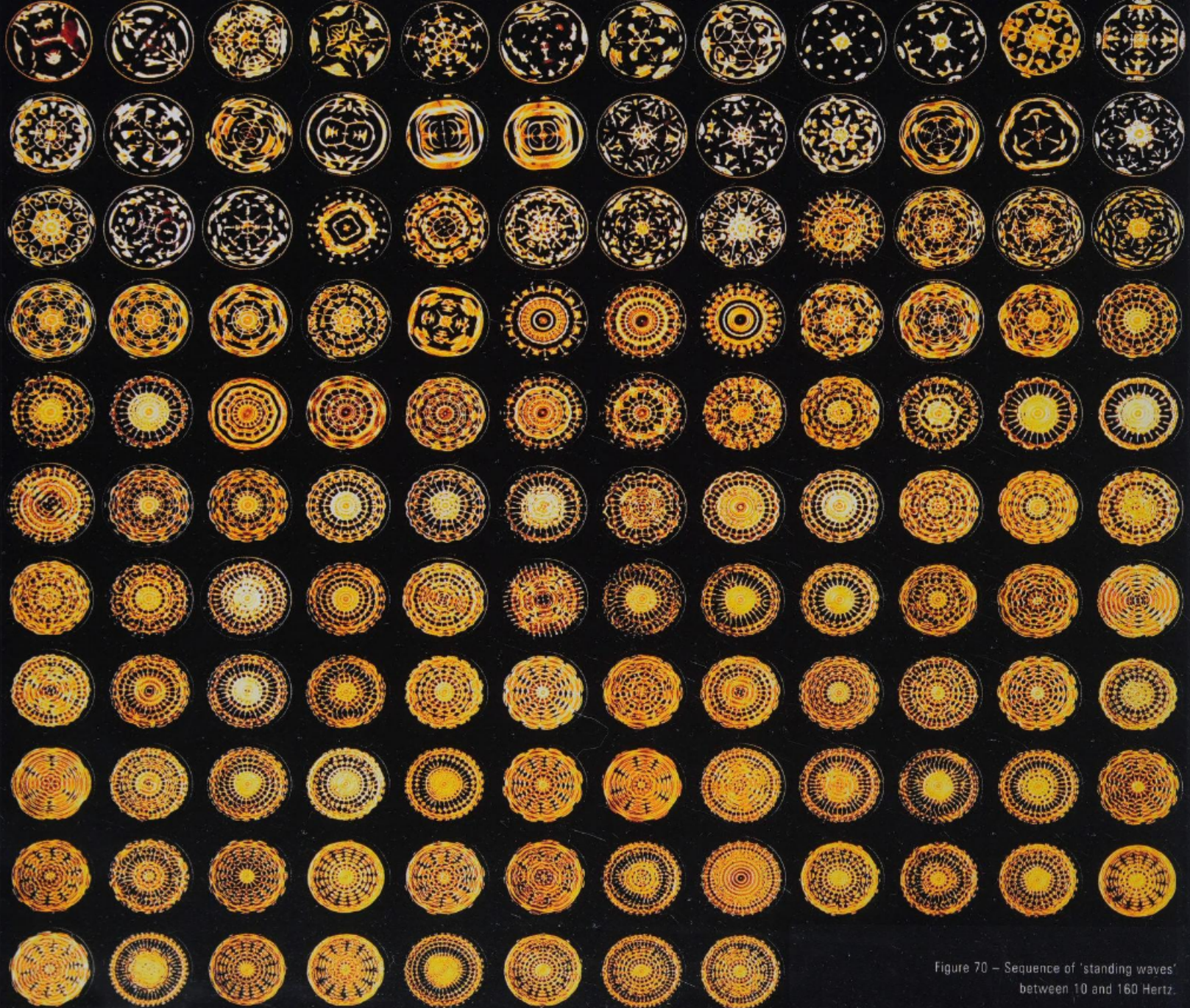


Figure 70 – Sequence of 'standing waves' between 10 and 160 Hertz.

But how do the structures visible in these photos, come about? The water container is set into vibration from the bottom similar to the experiments for the Chladni sound figures. Distilled water is used, without any chemical additives or other reflective means.

The water surface is illuminated almost vertically, straight down, and the camera is positioned along the same axis. Only some of the light striking the surface is reflected back to the camera. It either hits the upper edge of a wave crest, creating brighter and sharper contoured lines, or the bottom of the wave trough, yielding darker, somewhat wider lines. Light that hits the oblique, receding or rising surfaces, is diffracted sideways, and since no light reaches the camera from these locations, these areas appear black in the photo. But other superposition of additional cross reflection can also occur. Hans Jenny pointed out how Chladni sound figures with sand or powder as the indicator of vibration, and sound figures formed with water, are reflexive to one another. The bright lines of the Chladni sound figures show the resting lines of the nodes, while the bright lines seen in the oscillating water indicate the location of the strongest vibration [the wave antinodes]. These correspond to the dark areas in the sand patterns, while dark areas in water patterns indicate stationary, or less strongly oscillating zones (JENNY 1967: 28).

Similarly to the Chladni sound figures, many intricate types of shapes and structures can be demonstrated through experiments with standing waves. The sequence of shapes and structures in figure 70 on the opposite page, was created in a small container of about 4 cm diameter with a water depth of 8 mm, while the frequency was gradually increased from 10 to about 160 Hertz.

The following basic processes could be observed:

1. Lower frequencies create fewer but more pronounced waves; at higher frequencies the patterns become more delicate and differentiated.

2. Two types of waves can be distinguished. Concentric 'ring waves' propagate outward from the center to the rim, are reflected there and return back to the center. 'Radial waves' move along the rim, their wave crest edges passing through the center like rays. Most structures develop as a mixture of both wave types, except at very low tones and low amplitudes, where only ring waves can develop.

3. With a slow continuous increase in frequency, moments of clear, resting structures, called 'standing waves,' develop between phases of chaotic wave movements. These standing wave patterns follow in different frequency intervals and display a ray-like structure with 2, 3, 4, 5, 6, 7, and even more rays, with a nearly limitless multitude of form and breadth of variation. As is comparable to the stages of metamorphosis so often seen in natural forms, the transition from one solid structure to the next occurs through a dissolution of the previous structure and only then may the restructuring occur.

4. Looking at this from the point of view of physics, the lower frequencies are more like 'gravitational waves' (gravity is the force that pulls the crest back into the surface) and the higher frequency ranges are more like 'capillary waves' (where the surface tension of the water is the leveling force). No consistent rules have been discovered and formulated for the occurring number sequences.

The most obvious thing about these images is the clear geometric structure of the patterns with their corresponding number sequence. Studying these, one can experience very viscerally, that numbers are more than mere counting units, with which quantities can be summed up in sequences.

They are immediate signatures of a structuring, ordering and creative process, a qualitative principle. Numbers are not distinguished by their quantitative size, but much more through their quantitative 'power' to structure wholeness and unity. «3 is a specific type of unit, 5 is a different type of unit. Thus the different numbers become different types of the same unit» (BINDEL 1980: 25). The particular number, with the order arising from it, is an expression of the relationship of its structured arrangement to the whole.

This principle corresponds to the phenomenon of the overtone series of an oscillating string. From the oscillation of the whole length of the string, the base [fundamental] tone emanates. All higher partials or overtones sound through the different integral divisions of the string, so that each overtone relates to the base tone in a very specific relationship—that of the interval. At the same time it sounds qualitatively different and unique, when compared to the base tone, highlighting its appearance (ibid: 26) (Figure 71).

Inherent within numbers is a rhythmically-ordering or even a creative force. This is why there have been many different number systems throughout the history of humankind. Those systems were fundamentally characterized by different compositional rhythms (ENDRES/SCHIMMEL 1998: 15) as, for example, the familiar decimal system with 10 as its unit, the binary system developed by W. Leibniz with 2 as its unit, or the sexigesimal system of Babylon, «that, after the unit 'ten,' knew a higher unit 'sixty' which we still experience through the 360 degrees of a circle and in hours, minutes and seconds» (ibid: 16).

So it is not surprising, that not only the creations of humankind–works of art, architecture and technology–are governed through and through by orders of numbers, but that we also find numerical relationships in the shapes and forms of nature everywhere–sometimes obvious, but often times hidden. We encounter these ordering structures in the inorganic world of crystals as well as in the realm of organic life forms.

Formation in nature primarily begins in a liquid medium, whether this be the growth of crystals or of stones being created from molten lava, or the morphogenetic composition processes of organisms, for which water is the primal and fundamental starting point. Because of water's high «impressionability» (SCHWENK 1962: 26), or as Novalis (1957, I: 268) poetically stated «it is the sensitive chaos»—it offers the possibility «to create form out of different forces or directions of movement, a principle which, for example, plays an important role in embryogenesis. Nature is...permeated by these rhythms and movements penetrating each other, which arise from amongst themselves» (SCHWENK 1962: 32). The comparison

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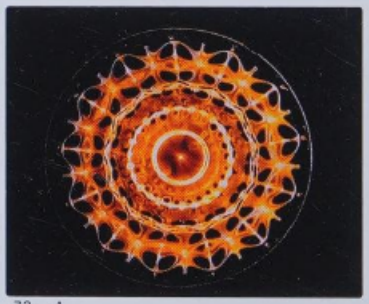
72 – 2

72 – 3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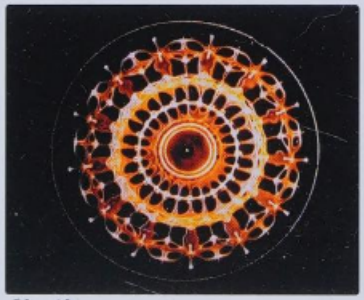
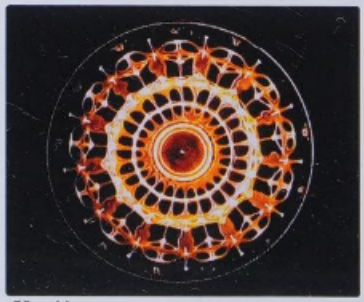
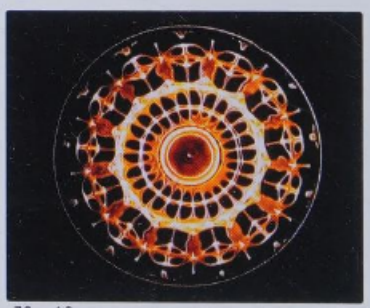

72 – 10


72 – 11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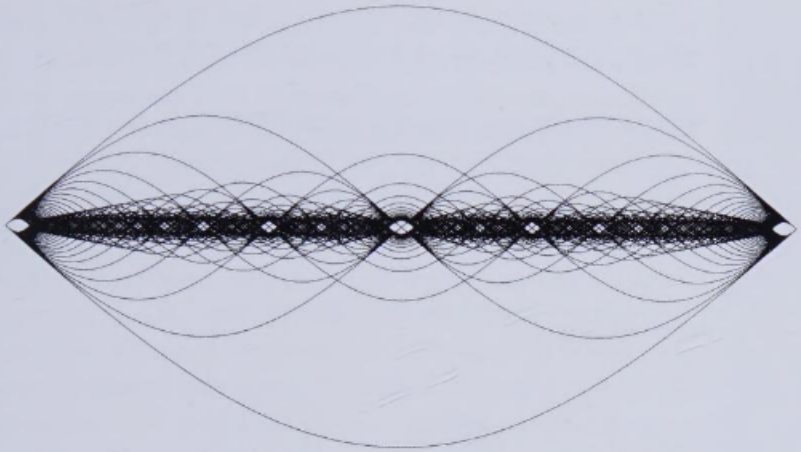


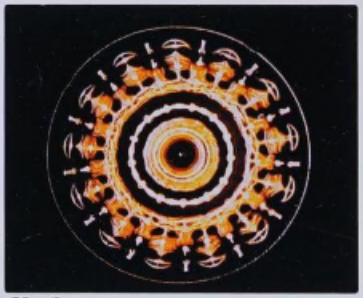
Figure 71 – Above: Ideal structure of an oscillating string (Peter Neubäcker, Munich).

Figure 72 – Below: A 'standing wave' is characterized by the fact that the initial crest of a wave changes into a trough and then again back into a crest. By means of a sequence of still images from a video, these changes can be easily observed in the circular and radial waves. The sequence of 16 still images below demonstrates this shape-shifting, on the basis of a structure of 13 radial spokes on the surface of water oscillating at 63.8 Hertz. In image 1, the crest of a wave appears as the thin linear forms at the perimeter, similar to the tick marks on the face of a clock. With each image, up to 8, these are changing into troughs. Where there was a line before, there now appears an arched or dome-shaped form. Continuing to image 16, troughs gradually transform back to crests. Image 8 shows a phase shift as compared to image 1, and image 16 completes the cycle, having reached again the initial condition. The circular waves go through a similar cycle of oscillation.

72 – 5

72 – 6

72 – 7



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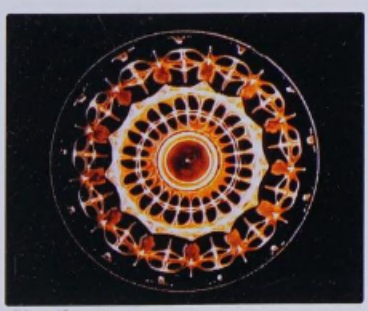

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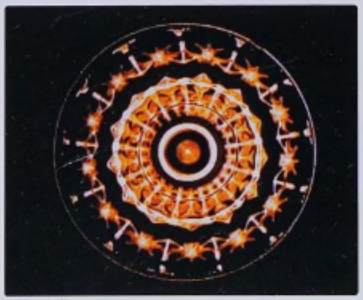


72 – 15

72 – 16

of water-oscillation images with orders of numbers and shapes in nature reveals great similarities within the fundamental structures of their construction. This may be a hint as to the inner relationship of their development processes, but without relegating the natural processes of evolution to purely mechanical effects of oscillations, as they have been employed in the experiments to realize these images. These image sequences are supplemented by works of human creativity, as also the artistic, creative mind expresses itself through the language of these primal forms.

In the realm of plants, where we would not necessarily suspect geometry to play an active force, we see an astonishing numerical order in the arrangement of leaves and particularly the petals of blossoms.

All monocotyledonous blossoming plants (lilies, tulips, etc.) exhibit a 3 or 6 petaled blossom structure, and the dicotyledonous (e.g. roses) a 5 petaled; but very few plants exhibit blossoms that are arranged in fours. But the relationship of forms of blossoms and oscillating structures goes

Figure 73 – Classification of blossoming plants with a cross-section of the blossom (from EWALD, Vol 1, 1961)
[A reprint from a classical text book in biology, listing 1. Class: two-germinal petal plants (Dicotyledonae), and
2. Class: single-germinal petal plants (Monocotyledonae)]

even deeper. The oscillation picture of 28.9 Hertz (Figure 75) shows, at first glance, a hexagonal structure emanating from the center; but upon closer examination we discover that the 6-fold symmetry consists of two 3-fold structures, that not only show different form elements but are also polar opposites; one point is directed upwards, with the opposing form downwards. What this reveals concerning the waveform of the oscillating water is that, at the moment the photograph was taken, the one 3-ray figure corresponds to the momentum of the wave crest and the opposing figure to the wave troughs between them. Considering 6-fold natural forms with this in mind, one realizes, especially for tulip and lily blossoms, that not all six petals have the same shape. We find that the three more pointed sepals, and the three more rounded petals, are arranged in the same polar fashion as in the oscillation patterns (Figure 76). Even among snow crystals, which are almost perfectly symmetrical, bi-polar structured specimens can be found (Figure 74).

This image of the mutual penetration of two polar triangles is considered by many cultures to represent the most fundamental principle of creation—the successive unification and harmonization of all opposites (Figure 85, Page 82).

In the structure of 4 or 5-fold blossoms (or multiples thereof) this type of difference amongst the shapes of the petals themselves does not occur. The only case I know of is the wax plant (*hoya carnosa*, Figure 81, Page 81), which exhibits such a phase-shifted arrangement of the different parts of the blossom as we see in the oscillation forms. But the five green bud

Figure 75 – 'Standing wave' with bi-polar triangular structure, 28.9 Hertz.

Figure 76 – Blossom of a lily consisting of two sets of bi-polar three-leaved petals and sepals.

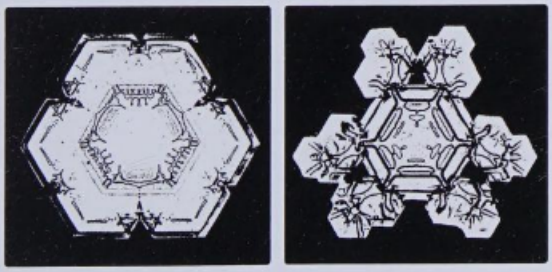


Figure 74 – Snow-cristals with bi-polar, inner structure with three elements (from BENTLEY/HUMPHREYS 1962)

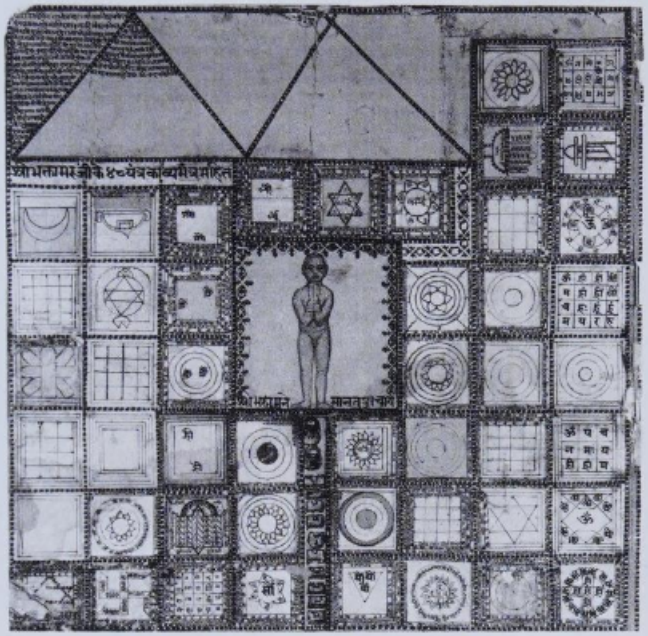


Figure 77 – «The Yogi and His Symbols», Rajasthan, 18th century.

«Each of the little diagrams presents a different system or way of thinking for the understanding of the world and its structures. The first task for a student of spirituality is familiarization with the different paths of contemplation, and a harmonization of the five universal elements of which his body consists (earth, water, fire, air and *prana* or ether). His clear understanding of inner and outer worlds depends on the harmony he is able to create between the elements within his own body, and those same in nature. Each of these geometric cosmograms is there to assist him in his efforts for liberation through harmonization» (LAWLOR 1990).

leaves and the five-colored petals of the rose, follow precisely the principle of the phase-shifted arrangement which we have already seen in the five-pointed star form of the oscillating water drop (Figure 79).

While this symmetric 'construction plan' is often plainly evident in the plant kingdom, from the single-celled diatom to the complex flower, in the animal world its basic structural order is more hidden. Only in the *radiolaria* and the Typus *coelenterate* [radially symmetrical animals having saclike bodies with only one opening and tentacles with stinging structures] like jelly fish, sea urchins and star fish, is this shape-determining principle visible.

Orders of numbers appear in oscillation images of standing waves that are never observed in nature, or only very rarely, as a spatial form. One such example is the number 7 which can be found in the plant *Siebenstern* [seven star] and in a variation of the jimson weed. Otherwise the influence of the number 7 is more hidden as a temporal rhythm (see images on page 90).

But perhaps most surprising is that this perfect spiral pattern (Figure 112, Page 94) emerges spontaneously, without manipulation, as an oscillation form in water–the spiral which is the most universal primal cosmic shape, permeating everything from the most minute structures right up to the scale of galaxies.

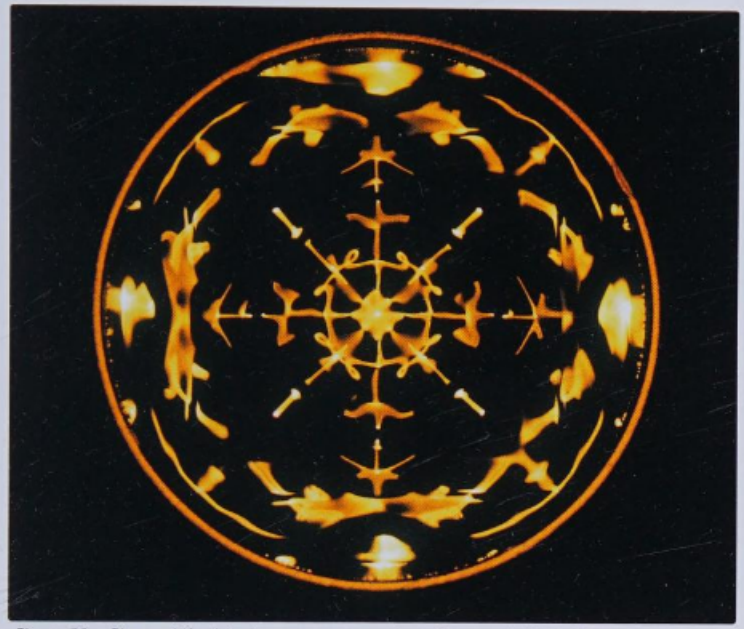


Figure 78 – Phase-shifted 4-element structure: 'standing wave' 24.24 Hertz.

Figure 79 – Phase-shifted 5-element structure: 'standing wave' 38.45 Hertz

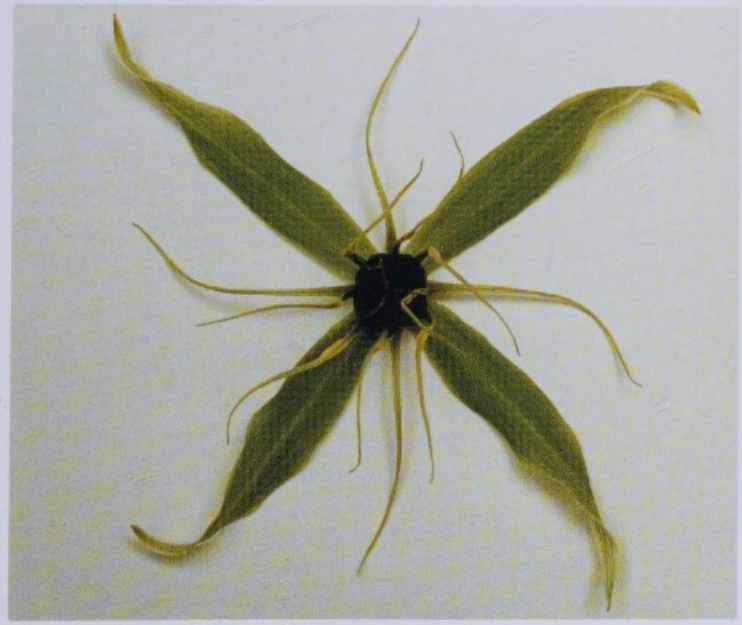


Figure 80 – Blossom of Paris *quadrifolia*.

Figure 81 – Blossom of the wax flower.

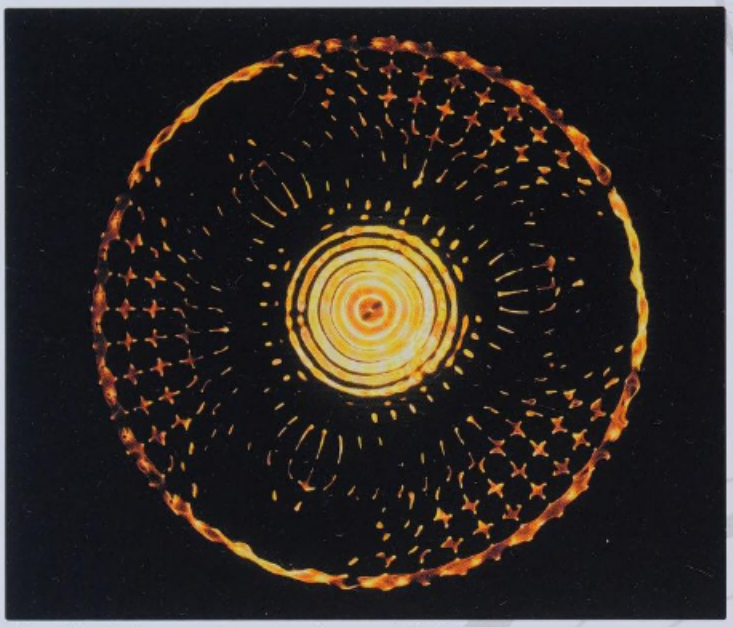


Figure 82 – 3-element structure: 'standing wave' 52.47 Hertz.

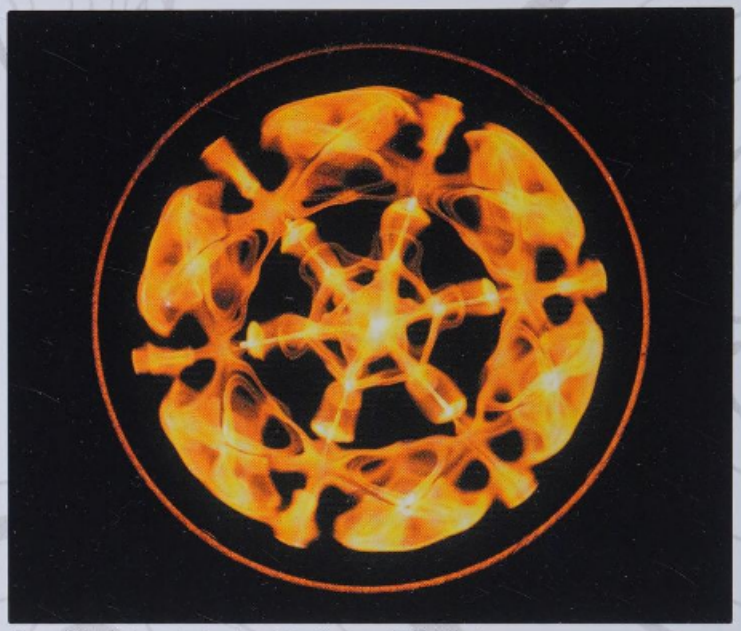
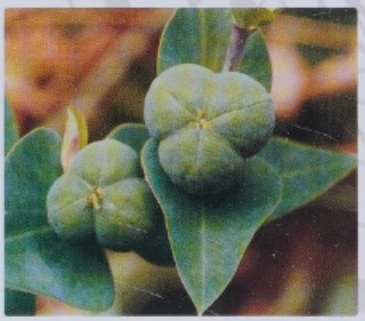


Figure 83 – 6-element structure: 'standing wave' 20.1 Hertz.

Figure 84 – Natural and man-made forms made with 3 and 6-element structures respectively. In the background different diagrams of plants and blossoms (from BENESCH 1990).



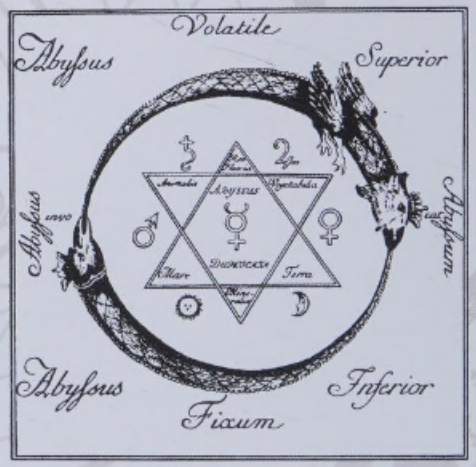


Figure 85 – From: Nicolas FLAMEL, *Works on Alchemy*, Edition Hamburg, 1681.

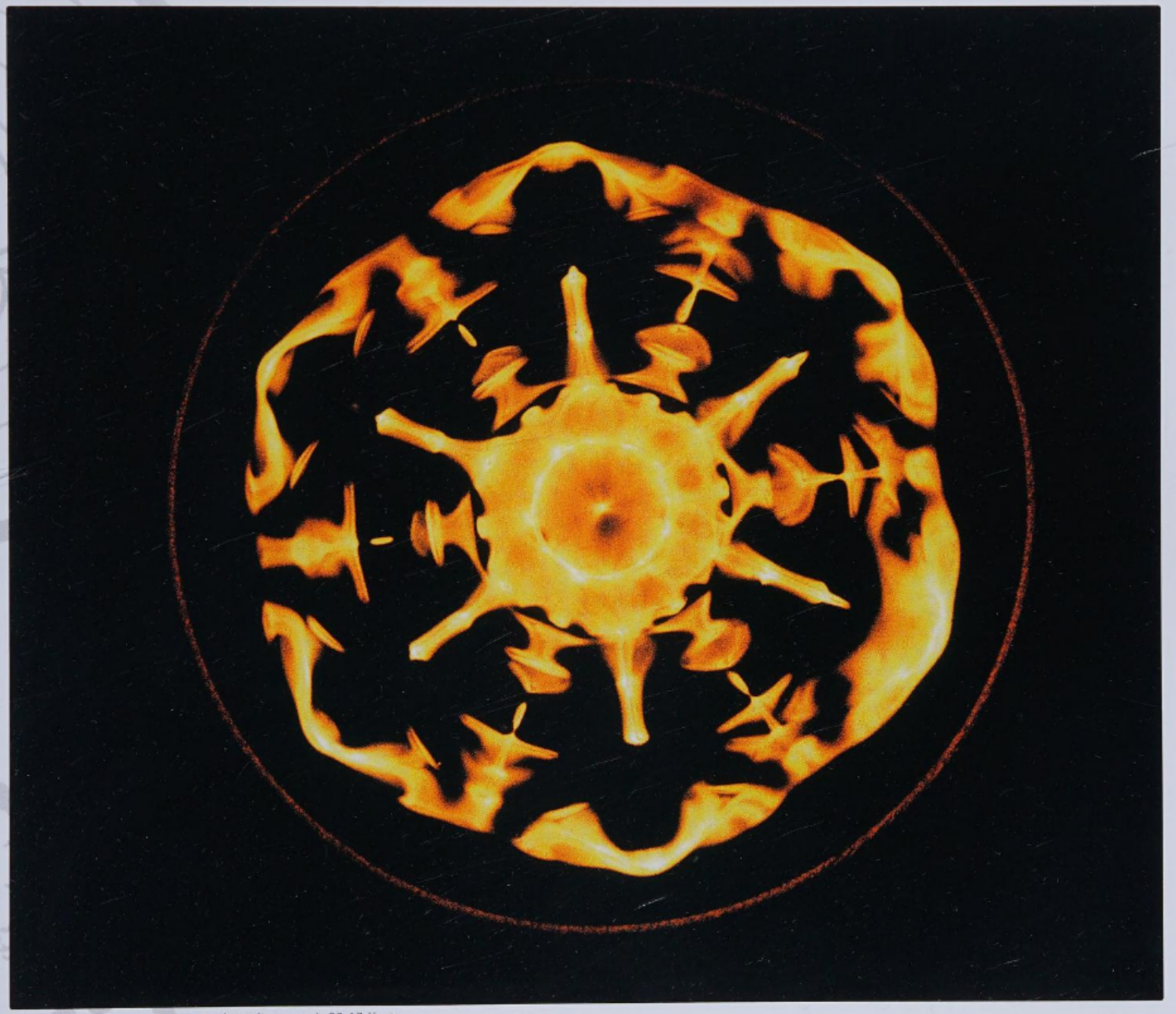


Figure 86 – 6-element structure: 'standing wave' 33.17 Hertz.

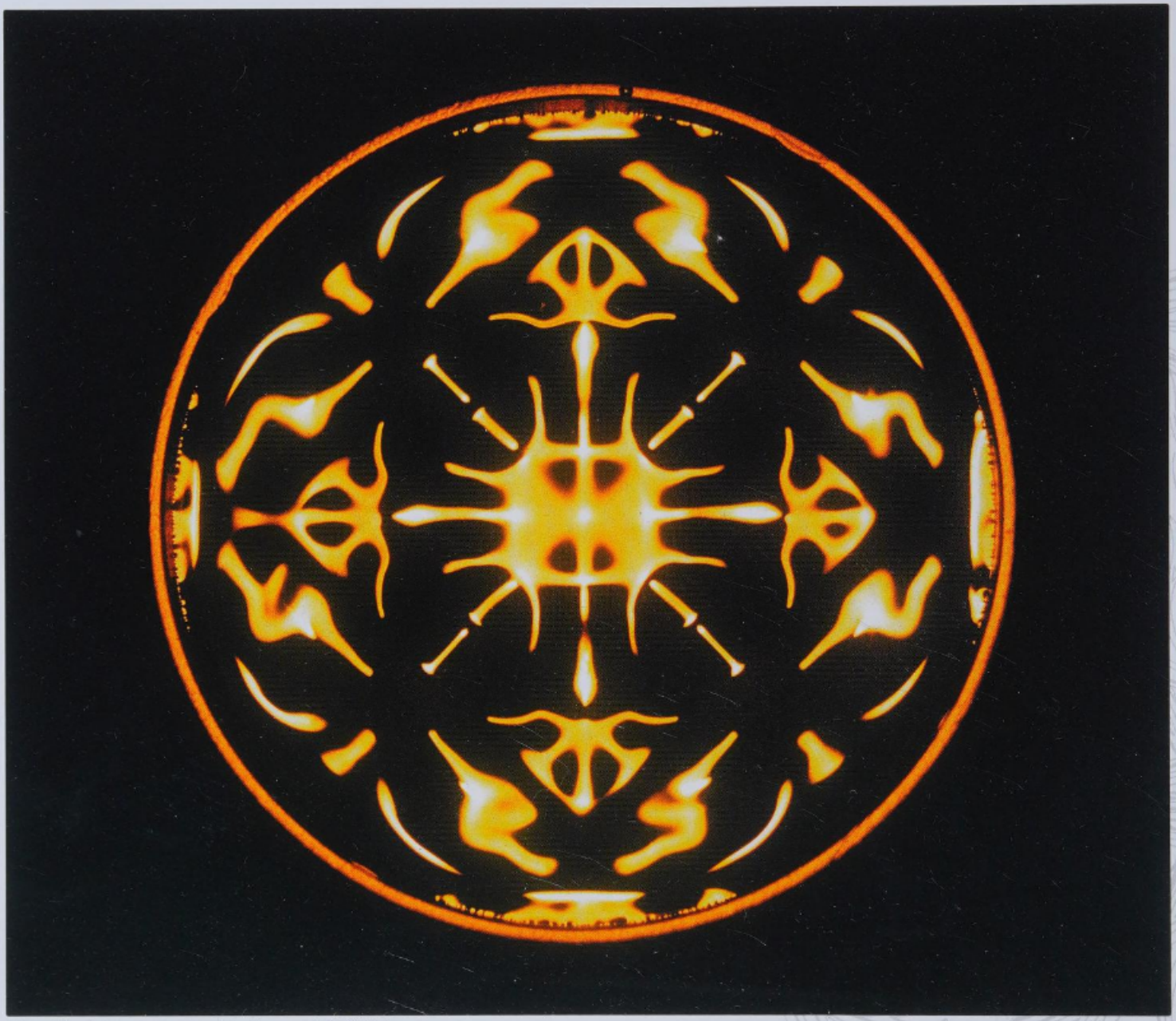


Figure 87 – 4-element structure: 'standing wave' 25.38 Hertz.

Figure 88 – Nature and art-forms with 4-element structures: blossom of the Clematis (above), a cactus (left) and drawing of a church window (below) (church window from BINDING 1989).

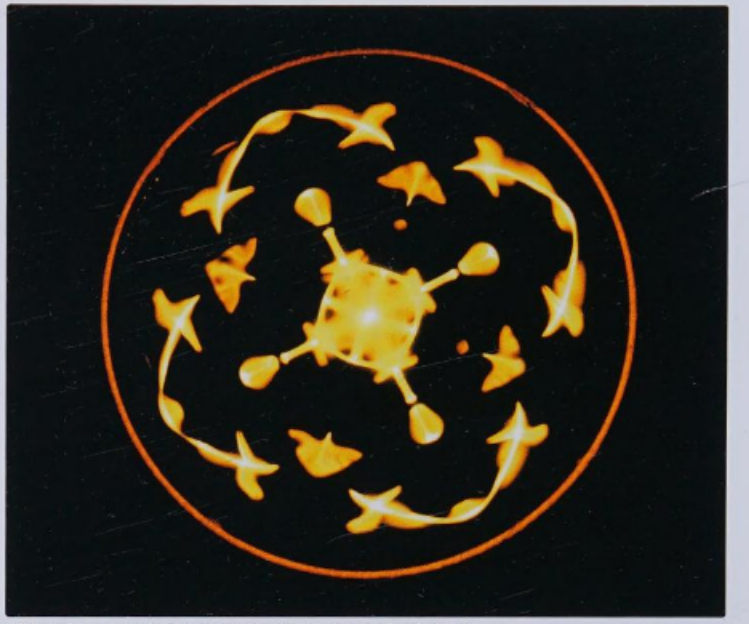


Figure 89 – 4-element structure: 'standing wave' 24.2 Hertz.

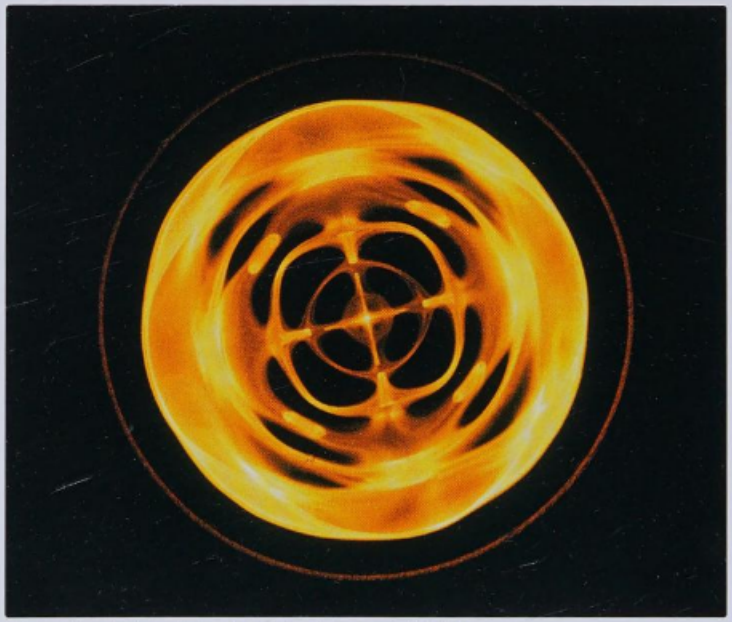


Figure 90 – 4-element structure: 'standing wave' 23.7 Hertz.

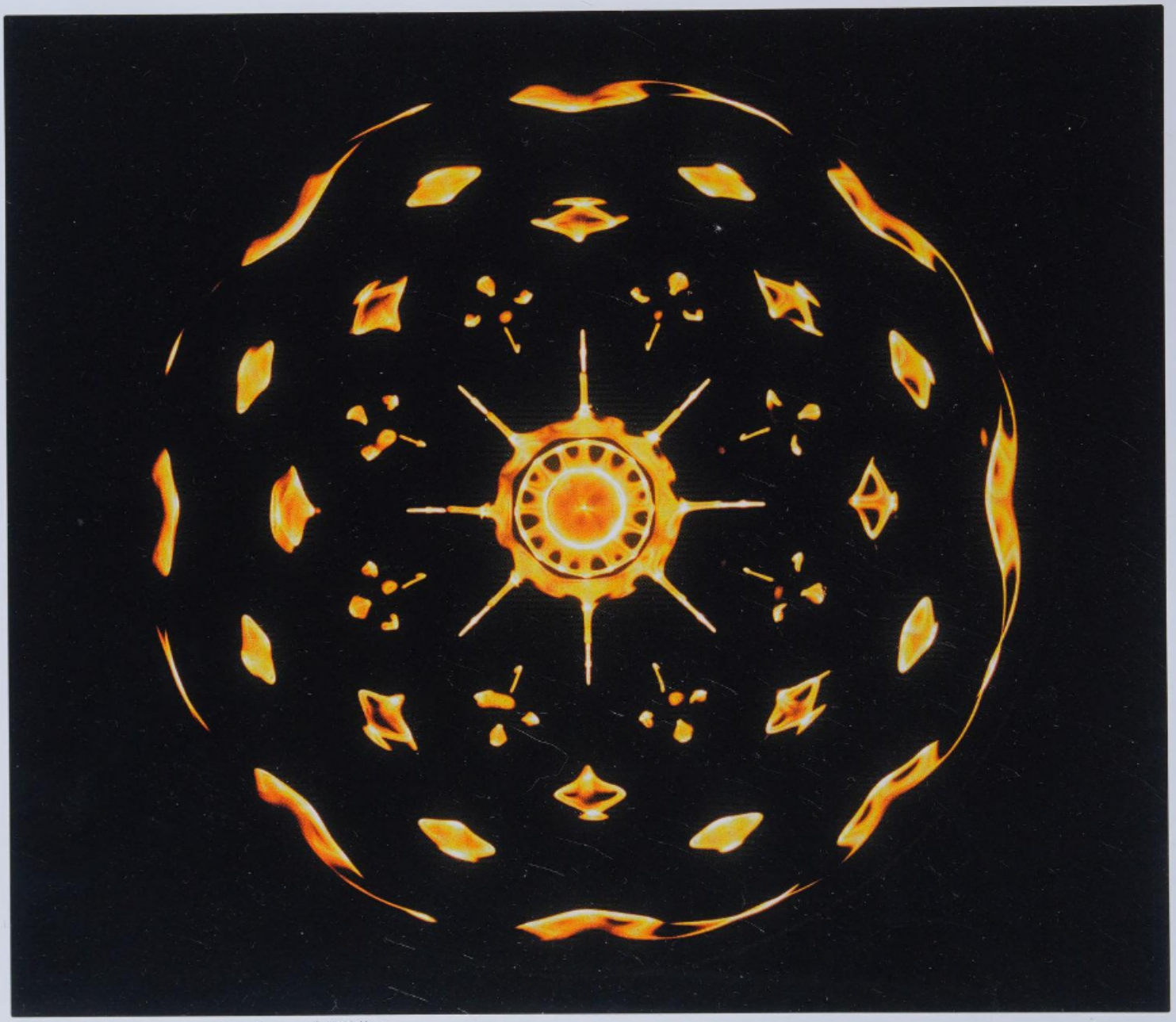


Figure 91 – 8-element structure: 'standing wave' 27.9 Hertz.

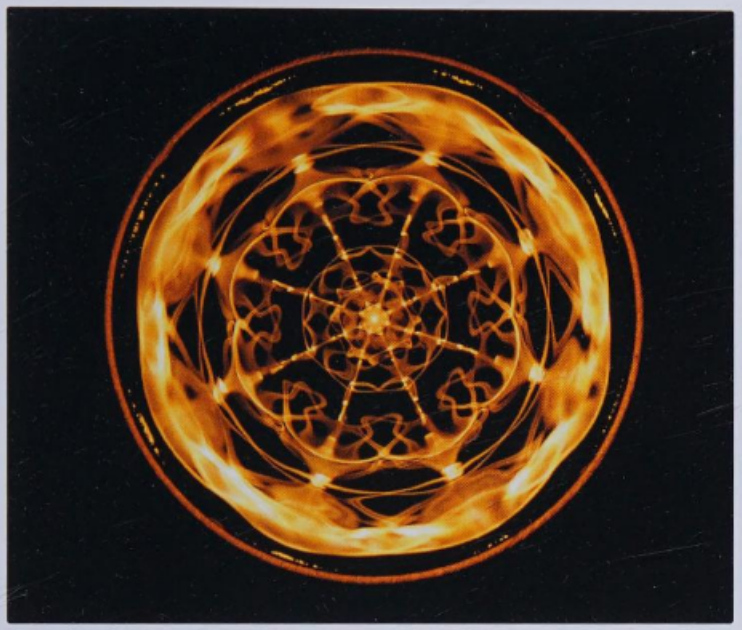


Figure 92 – 8-element structure: 'standing wave' 34.35 Hertz.

Figure 93 – 8-element structure: 'standing wave' 24.24 Hertz.

Figure 94 – 4-element natural forms: left jelly-fish (from HAECKEL 1974), right blossom of privet.

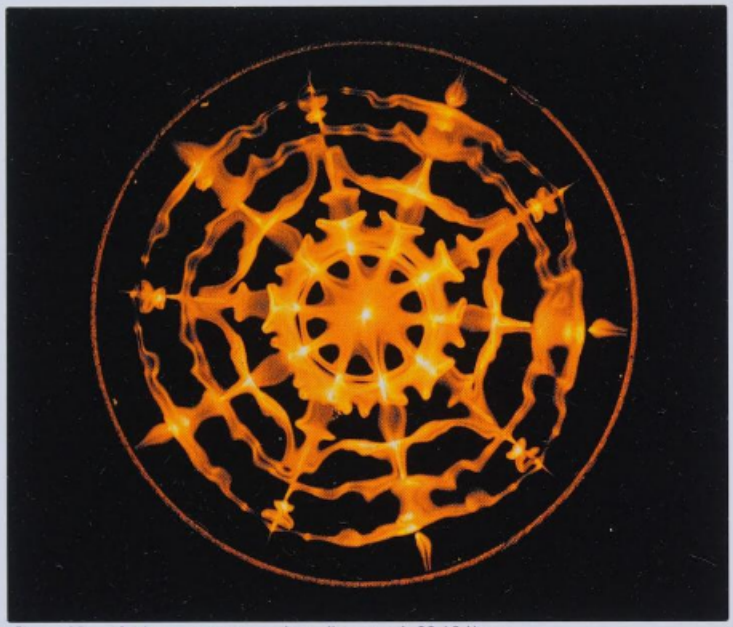
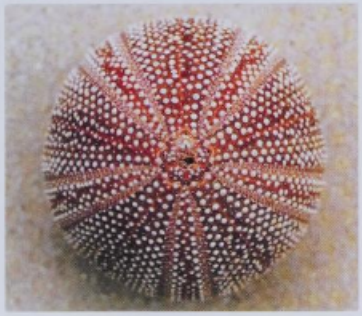
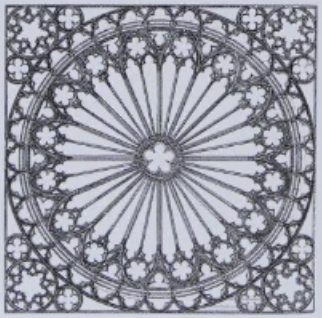


Figure 95 – 10-element structure: 'standing wave' 22.12 Hertz.

Figure 96 – Above: Starfish (from HAECKEL, 1974).

Background image: Geometric rhythm of planetary orbits (from NEYBÄCKER, Munich).





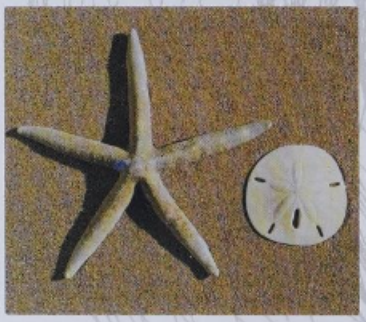


Figure 97 – Left: Natural and man-made forms with 5-element structures (Blossoms, shell of a sea urchin, Rosette of Strasbourg, starfishes).

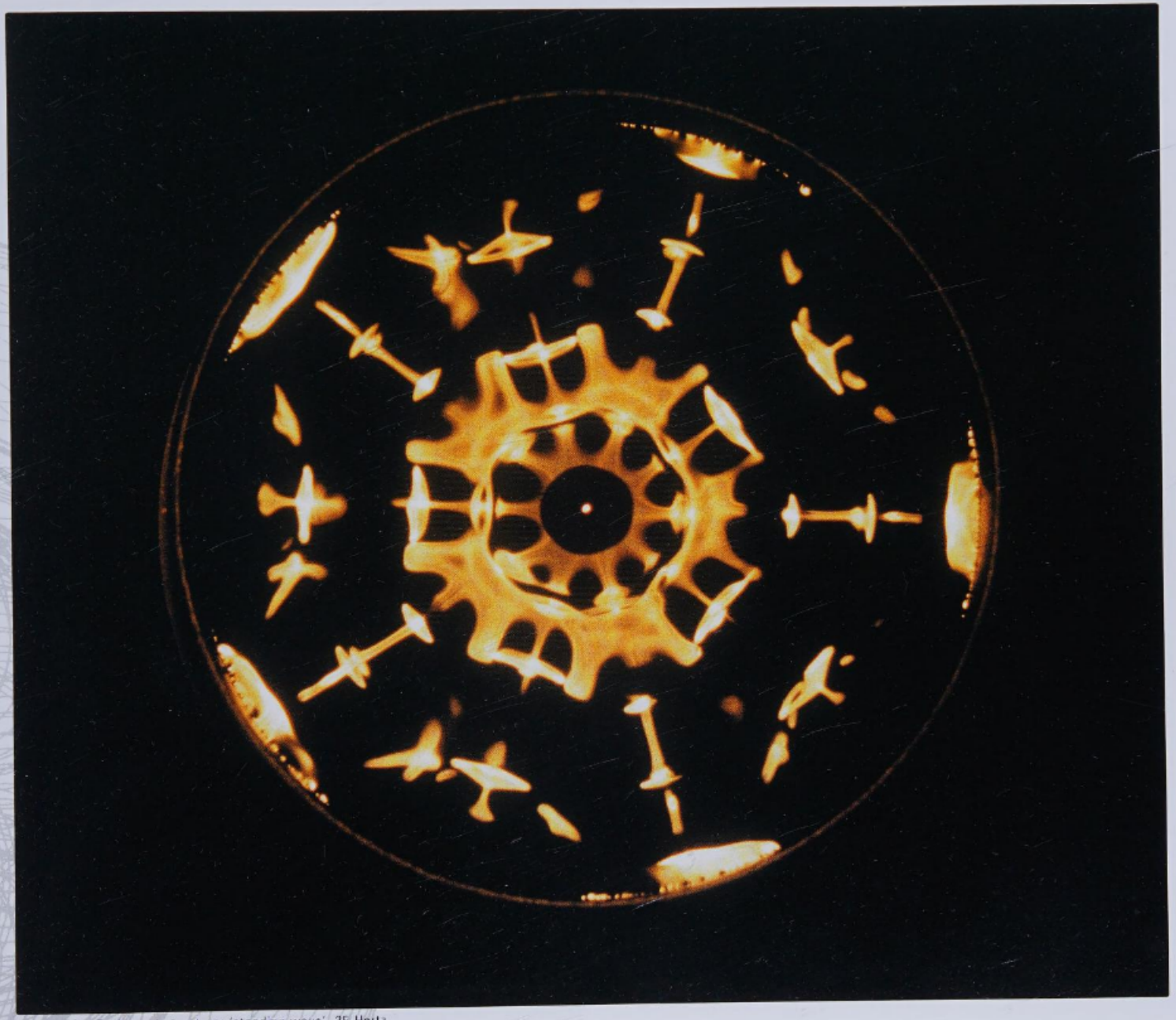


Figure 98 – 5-element structure: 'standing wave', 25 Hertz.

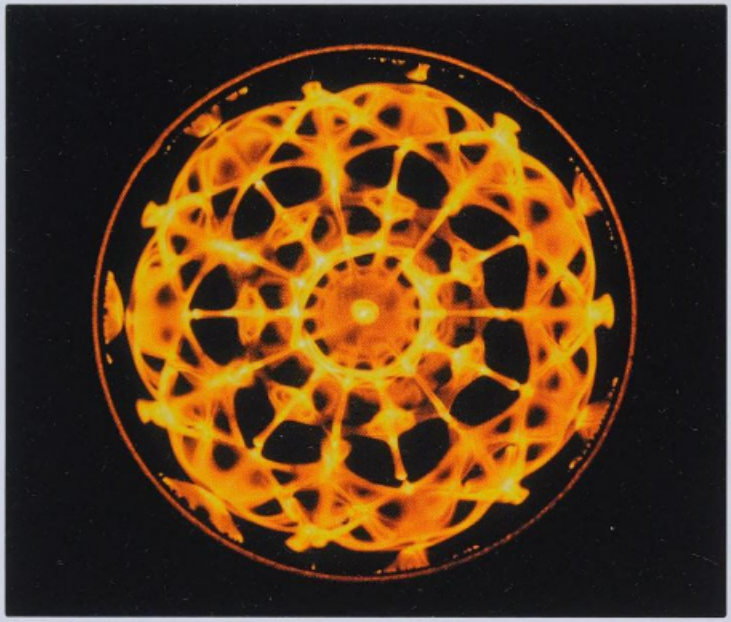


Figure 99 – 7-element structure: 'standing wave' 79.7 Hertz.

Figure 100 – Variant of a 7-element blossom of the jimson weed.

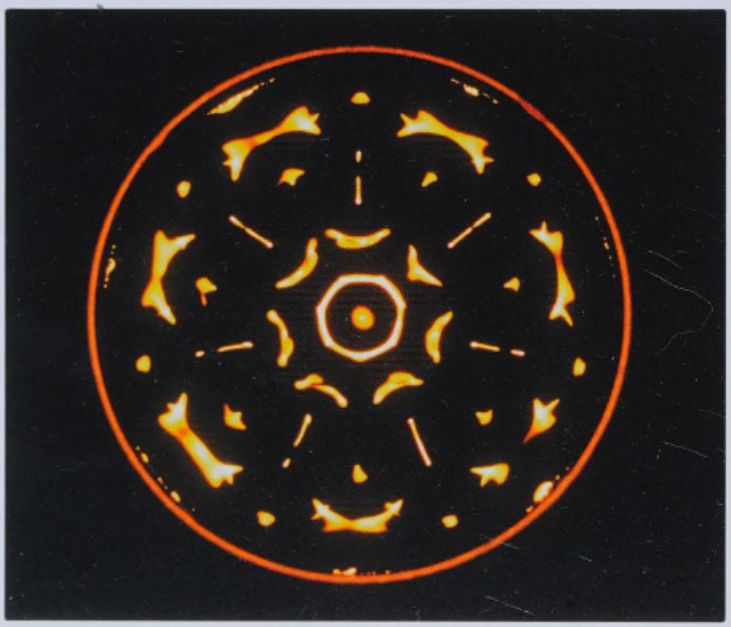


Figure 101 – 7-element structure: 'standing wave' 35.8 Hertz.

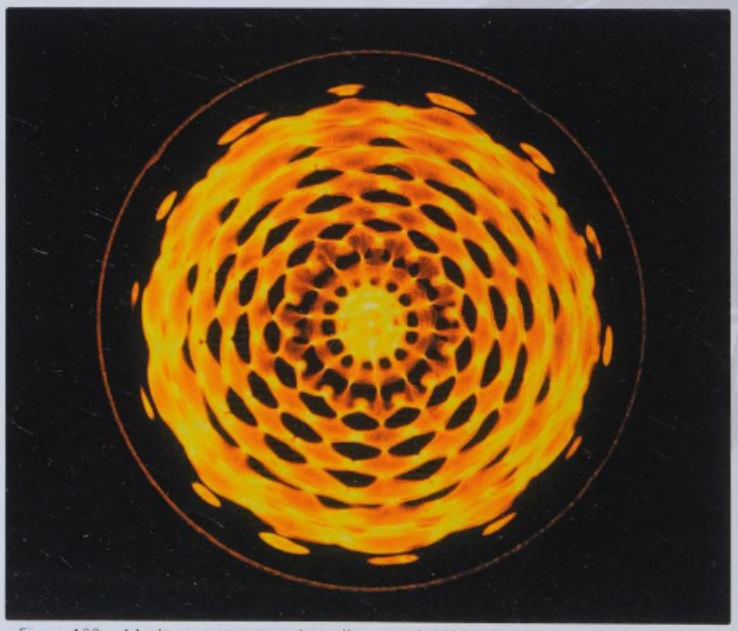


Figure 102 – 14-element structure: 'standing wave' 115.43 Hertz.

Figure 103 – 12-element structure: 'standing wave' 30.5 Hertz.

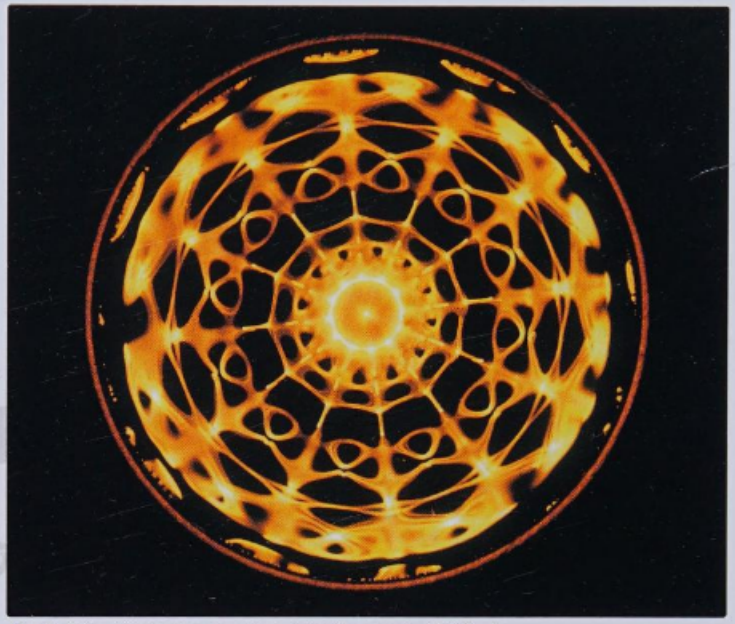


Figure 104 – 12-element structure: 'standing wave' 45.7 Hertz.

Figure 105 – 12-element structure: 'standing wave' 55 Hertz.

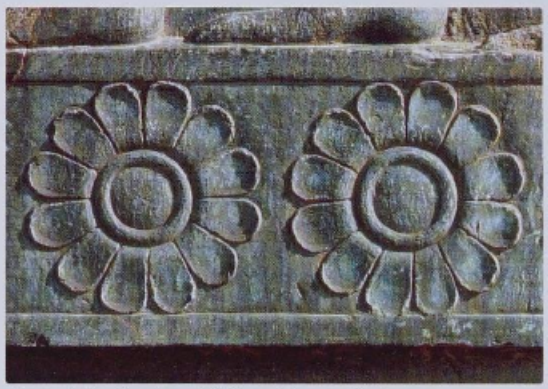


Figure 106 – Rosettes. Buildings of Persepolis, Iran.

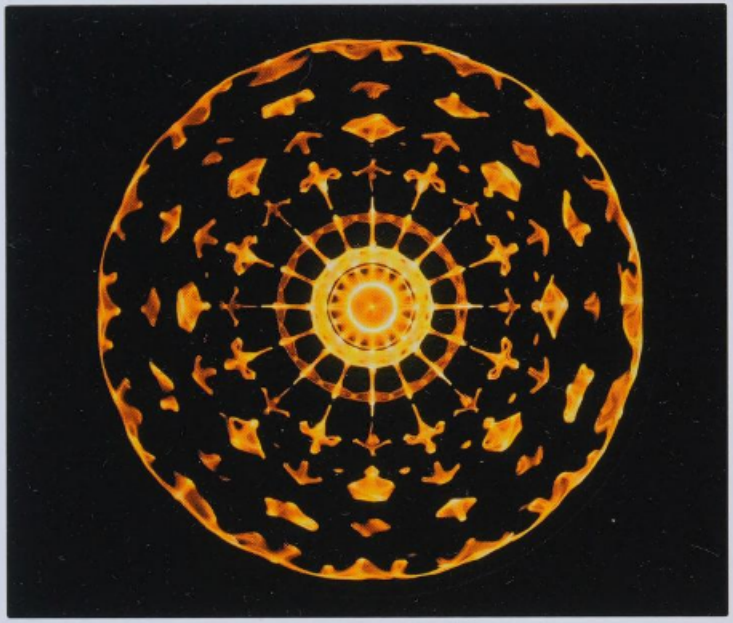


Figure 107 – 16-element structure: 'standing wave' 27.9 Hertz.

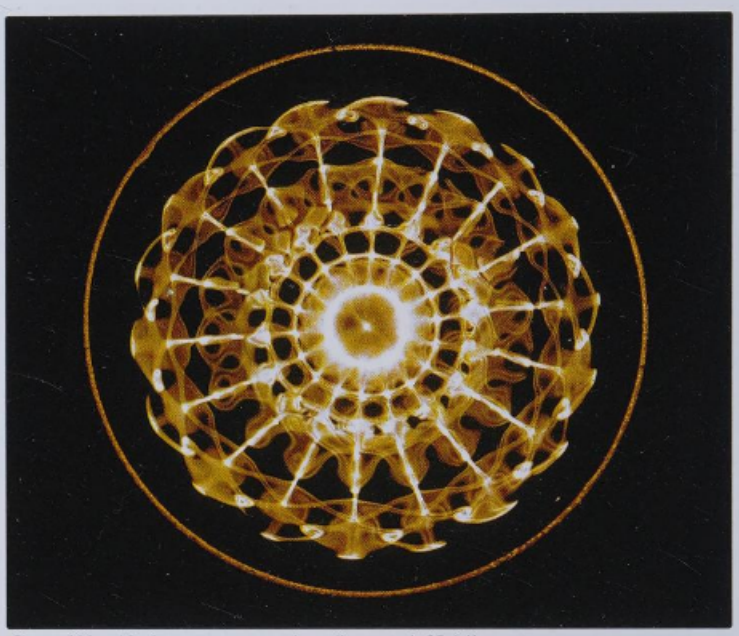


Figure 108 – 18-element structure: 'standing wave' 35.1 Hertz.

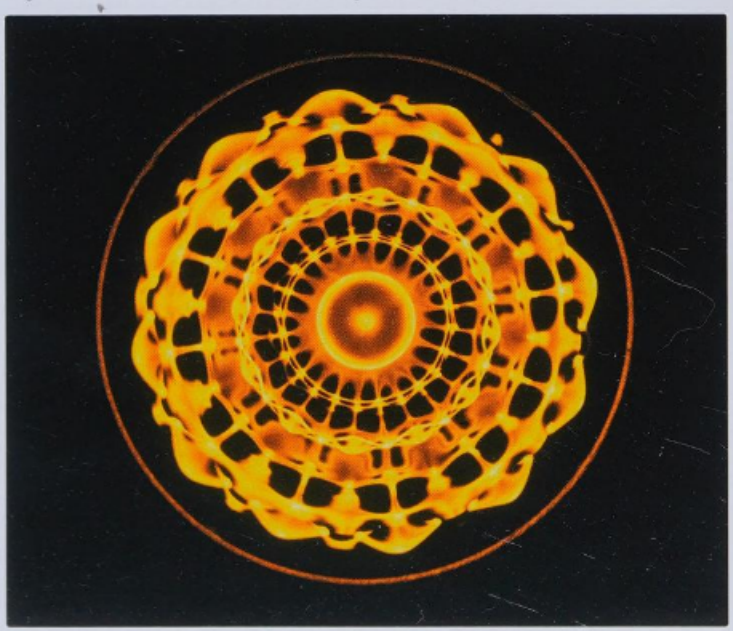
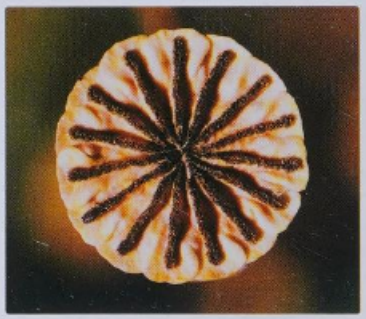


Figure 108 – 18-element structure: 'standing wave' 57.2 Hertz.



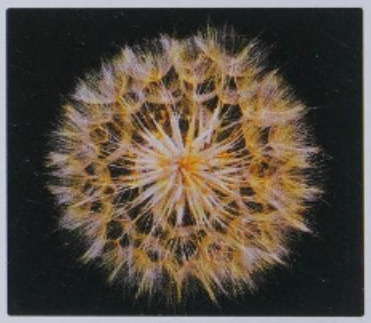


Figure 110 – Multi-elements in the seed vessel of poppy (above), pollen stand of 'Meadow Goat's Beard' (above right) and the flower of chicory (bottom right).

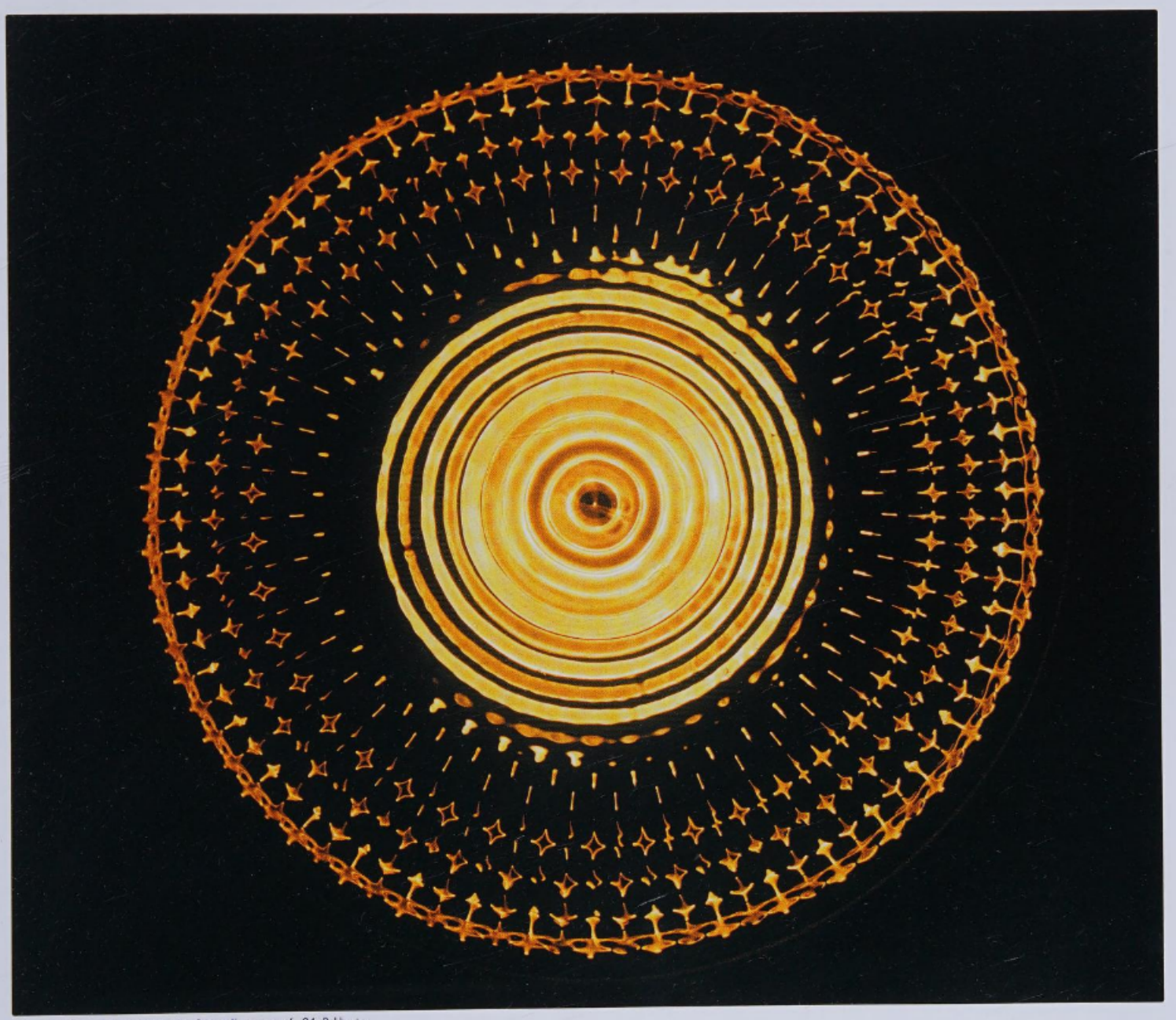


Figure 111 – Multi-element: 'standing wave' 91.8 Hertz.

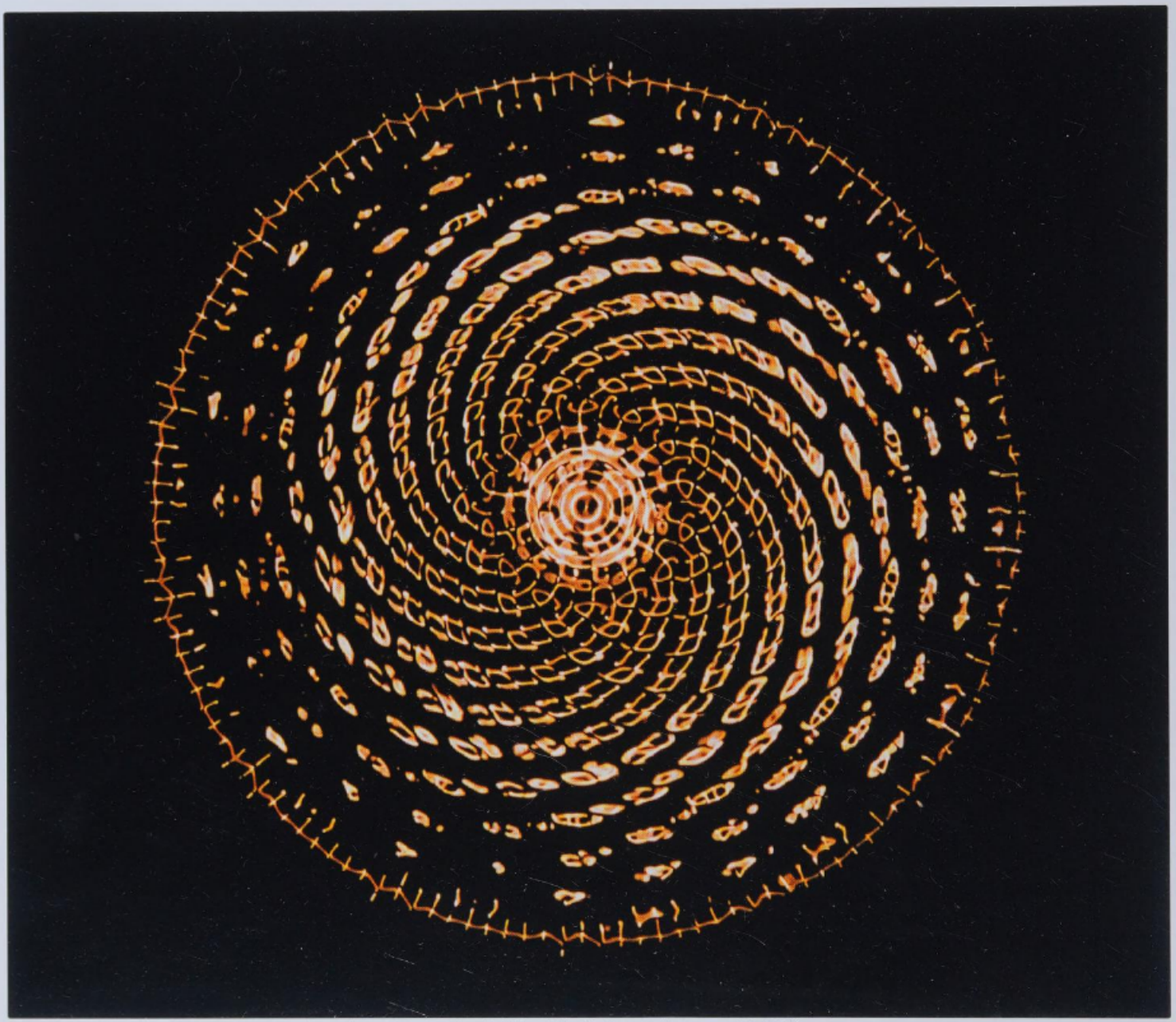


Figure 112 – Water-Sound-Image with 14 spiral arms formed in a water bowl of 20cm [8 inch] diameter, Frequency: 102.528 Hertz.

Figure 113 – Whorls in nature (top to bottom): water, shell of a grapevine snail (on the right, the common right-twisted, on the left, the very rare left-twisted form), cactus.

Given so many obvious congruencies between the oscillation images and forms in nature–congruencies that exceed mere external similarities, suggesting that an oscillation process may indeed be the intrinsic formative process–the question again is thrust upon us; «Just what is the origin of all forms and patterns?»

Throughout his 14 years of experimentation, Hans Jenny endeavored to assemble a comprehensive overview of these polymorphic phenomena so as to develop a profound understanding of the basic meaning of oscillation and processes of formation, or as Jenny worded it, «We want to have an insight into the way nature works.» (JENNY 1972: 171). [Publisher's Note: References to JENNY 1967 and 1972 cite the original editions (1967, Vol. I, bilingual; 1972 Vol. II, German or English) which are long out of print. The page numbers cited in this chapter are from the original English language edition, Vol. II, so they will be different than in the combined, English language edition, re-published in 2001.]

After extensively documenting his observations «that harmonic systems such as we have visualized in our experiments arise from oscillations in the form of intervals and harmonic frequencies» (ibid: 170), and after gaining knowledge of the «style of nature which is characterized throughout by rhythmicity and periodicity, so that we can speak of biological periodicity, even biological oscillation in the strictest sense» (ibid: 170), Hans Jenny comes to the following two conclusions: «if biological processes on and in the biological substrate proceed in an interval-like manner, there must be a corresponding pattern in this field of operation»; and: «if harmonic configurations appear in organic nature (morphological and physiological) then what we see before us is the result of the rhythms, intervals and frequencies of the generative factors. In other words: harmonic phenomena appear where the generative factors operate within a harmonic order» (ibid: 170).

For Hans Jenny it is without a doubt, that «This 'style as a process of becoming' must be an essential feature of the genetic field.» The only question remaining is «how nature proceeds in these matters» (ibid: 171). Future research could, in his opinion, orient itself toward the question:

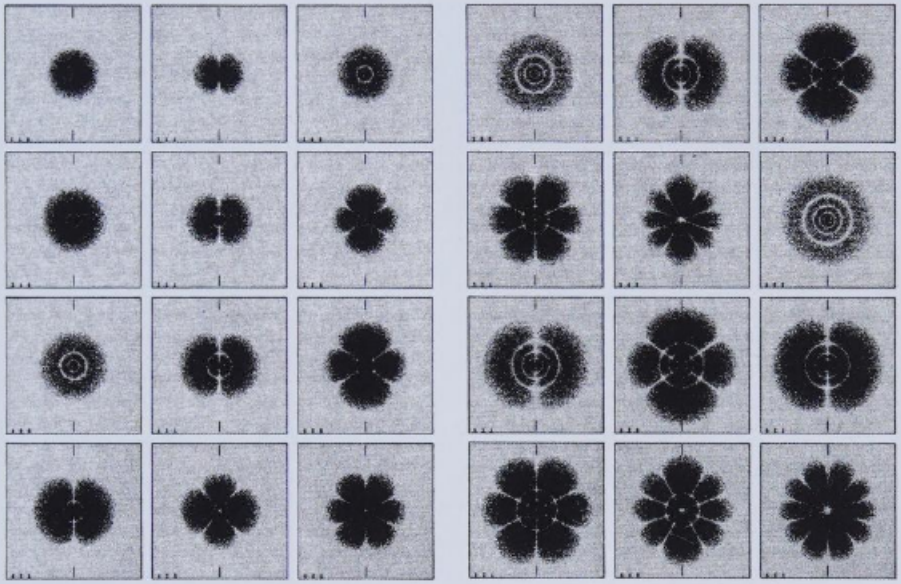


Figure 114 – «States of an oscillating hydrogen atom, depicted here as a cross-section through the center of the atom. Rotation around the indicated axis would portray the atom in three dimensions. White lines in the images indicate node-surfaces. Varying levels of gray indicate different amplitudes of oscillation in space. Each figure is characterized by three numbers, 'n', 'l' and 'm'. These are the so-called quantum-numbers, by which each *eigen* oscillation is uniquely defined. To compare the images by their size, one has to enlarge each image by the factor n (the first of the quantum numbers)» (HAMPRECHT in SENS 1993: 93f).

«How do the generative factors act to determine the embryogenesis of organisms which present harmonic forms throughout?» (ibid: 173). If in this way we would succeed to «discover a pattern of frequency in biology», then we would arrive «at the preliminaries to configuration, the processes which precede the appearance of structure» (ibid: 173). Should this really manifest as «harmoniously ordered operations of frequency» (ibid: 173), then there could be an «imaginable path through the 'oscillating spheres' leading to harmonically formed configuration» (ibid: 173).

These impulses, rhythms and intervals of this oscillating creative 'field'— where do they come from? Are they really only direct expressions of the «score» of the «gene orchestra» (ibid: 172) that organized and even composed its own score, as some researchers assume today? (cmp. DEUTSCH 1994: VI ff). Or is there a composer, a force that assembles everything? Interestingly Hans Jenny here talks about the gene orchestra and leaves open the question of the type of score and its place of origin.

It is exactly at this boundary between the just barely discernible, substantial structures and a possible organizing 'field,' where Rupert Sheldrake's (1990) concept of 'morphogenetics' or 'morphic fields' sets in. This concept, in its biological-scientific approach, pleasingly distinguishes itself, at least in its initial formulation, from the trite phrase «everything-is-oscillation.» However, on the other hand, it proves not too helpful any longer due to a number of unclear and questionable formulations and especially through its extrapolation, that it becomes no longer supportive for the clarification and consolidation of its own intention. But how is, according to Sheldrake, such a 'morphic field' to be understood? After extensive discussion of the different theories about morphogenesis (SHELDRAKE 1990: 100ff) he comes to the conclusion, that these fields don't do anything more than «what they are known for: they are encoding information for the sequence of chemical building blocks in RNA and protein molecules: it is not necessary to project the capability to organize the whole organism onto the genes» (ibid: 122).

For him it appears, «that the information lies in morphogenetic fields that act in non-material fashion» (ibid: 120) and organize inheritance in this way....the shapes of the cells, tissues, organs and the whole organism is not generated by the DNA but through morphic fields.... Genetic mutations can influence form and behavior but the activity patterns are inherited through morphic resonance» (ibid: 176).

To clarify the role of the gene endowment of an organism Sheldrake compares it with the electronic components of a TV set, of which nobody would claim, that «the images would be created from the components and their interaction and that they are programmed into the set» (ibid: 176). They are simply used to decode information transmitted «through the electromagnetic field of an oscillation of a specific frequency» (ibid: 176). «Form and behavior of an organism depend on the fields to which the organism is tuned» (ibid: 176). Sheldrake fails to see, «why organisms should not have their characteristic fields on all levels of the organic» (ibid: 157), and he continues: «Every insulin molecule is a manifestation of the insulin-morphic field» (ibid: 157). If in physics, a «particle is a manifestation of the fundamental reality» of fields (ibid: 108), why should that not also apply to the living organism?

Indeed, in quantum physics the attempt is made to explain the inner structures of matter through expressions like '*eigen* oscillation,' '*eigenfrequency*,' and 'resonance' as the physicist B. Hamprecht argues in his essay «The Music of the Universal Ether». Quantum theory does not «really deal with electrons, not even with electron clouds, and not any other quantity that is built according to the patterns of classical material categories, but with something non-substantial that oscillates; one could call it 'space par excellence' or more poetically, 'ether'; it is common to completely pass it by and just call it 'vacuum' in case of need» (HAMPRECHT in SENS 1993: 193ff.; cmp. JENNY 1972: 162ff. and GERTHSEN/VOGEL 1993: 176ff).[8] He goes on to explain that «particles and electrons in specific states are matched to the non-substantial oscillations of the vacuum according to a specific interpretation pattern» (HAMPRECHT in SENS 1993: 193ff., see Figure 114). In the innermost realms of matter, at the very bottom of the world, the human consciousness, on its search for that which «holds the world together deep inside» (GOETHE, Faustus I), finds something non-material, a vacuum, a nothingness, this «universal background» (DÜRR/GOTTWALD 1999: 228) of that «which can not be unstitched» (ibid: 273), as physicist, H. P. Dürr, expressed it.

«Atoms are the letters of nature—and the vibrations of the ether correspond to them. Both systems explain each other. The world evolved from a common atom and a common vibration.—Big and small atoms—big and small vibrations etc.» (NOVALIS 1957, I: 152)

«The atom is not a thing», Werner Heisenberg is believed to have said (quote after BRÖCHERS in SENS 1993: 8) –so did the development of modern physics during the last eighty years change our idea of reality and of the composition of a solid body, from the ground up. Since light as well as matter possess a 'dual, wave/particle characteristic' which is incompatible with the classic view, and as the «the particle does not exist any more» (DÜRR/GOTTWALD 1999: 228) we can no longer conceive of this frozen solid, dead, tangible 'something' at the heart of matter. The assumed final 'something' withdraws itself more and more from our grasp because it is movement, vibration and oscillation itself. We have to detach ourselves

[8] The question is, if the new approach in theoretical physics, known as 'String Theory,' has to be understood in this sense or if here the 'atom-particle' is just replaced by an even smaller particle, the 'string' (cmp. GREENE, 2000). According to String Theory «all matter and all forces emerge from a single base element: oscillating strings» (GREENE, 2000: 164). «The characteristics of an elementary particle, according to String Theory—its mass and charge as to the different forces—are determined by which of the possible characteristic oscillation patterns the underlying string executed» (GREENE 2000: 172). Compare GROTELÜSCHEN 1999: 88f., where it says: «The idea of String Theory is quickly summarized: the primal particle of the universe should be a one-dimensional string, shaped into a loop, similar to a violin string, it can oscillate in different ways and this creates different 'notes.' Each of these different quantum notes corresponds to a different particle, maybe an electron, a quark or a neutrino. The effect is similar to a fiercely plucked rubber band: the eye cannot follow the oscillating band. The brain perceives a kind of cloud, the thin band mutated into a laminar expanded object. The more strongly a string oscillates the greater are its mass and the charge of this particle created by its vibration.»

from the concept that there is a 'something,' which also oscillates, that would exist even without this moving oscillation, and to which the principle of movement is only added as something external.

Perhaps it is just the opposite, that the atoms and their grid structure are not the primary building blocks of which everything is constructed, but that instead these 'resting points' or 'structures' develop more according to the principle of standing waves as described above, in which a 'something' that is initially moving and oscillating comes to rest along its nodes and nodal lines and then coagulates into form. This is very similar to the organic processes of formation, in which embryonic origin begins as something liquid and moving, and only later does solidification set in until the form is completed. Might there be some hint in the German word for shape—*Gestalt*—*gest* and *alt* ['gesture' and 'old'] as gesture of the living that grew old and came to rest?

«Should not all spatial formation, from the crystal to the human, be explainable acoustically, through obstructed movement?... Thus spatial form be nothing but the figurative expression of music?» (NOVALIS 1968: 497)

Now that physics has demonstrated the courage (DÜRR/GOTTWALD 1999: 224ff.) to dematerialize the old understanding of matter, explaining it in terms of higher-order realities, why then should biology, the science of the living, not also do likewise and refrain from attempting to construct the phenomenon of life—the organism and its shape—additively from single components. Why not see, understand and honor 'Life' as an unstoppable oscillation between chaos and order, the swinging 'double movement' between the visible and the invisible, the tangible and the intangible: the pulsating heart of the universe, the source of the «endlessly creative music of the universe!»

«In floods of life, in storm of action,

I surge up and down,

Weave back and forth!

Birth and grave,

An eternal ocean,

A glowing life,

Thus creating at the whirring loom of time,

Knitting God's spirited gown.»

(Earth Spirit in J.W. GOETHE, Faustus I, verse 501ff.)

The process of the development of the 'standing wave' with its clear, elegant structures, could be seen as an allegory for the restless search of our mind in its quest for precision, order and clarity. In the water droplet, the well-defined form is the eventual result of a formative process which progresses through many agitated, indistinct, and repeatedly dissolving shapes.

Likewise, the observer's mind is initially confused by the multitude of incoherent aspects of the phenomenon. We struggle in our thinking, through unclear imagining, to find the structure [concept] in which, suddenly, everything comes together in harmony. As in oscillating water, all physical elements have to play together so that they start to resonate as a whole at a specific frequency and develop a clear shape. So too must one's thinking relate all aspects in such a way, that they vibrate in harmony, so that they reach an attuned resonance with the inner meaning of the phenomenon and that eventually the «good gestalt» (Max Wertheimer) appears as the clear expression—perhaps even revealing itself as a truly inspired idea.

Self-Organization and Formation

The question of morphogenesis, of formation, has become one of the leading-edge subjects in biological research. According to the well-known classical view, an inherited genetic program is developed over the course of evolution through accidental mutations and 'selection,' the latter being the mechanism favoring the one most able to survive. This genetic program contains the complete information for the control of all spatial and temporal organizational processes during the setup and the development of an organism.

It is revealing to observe, how new research results lead to an expansion of the current concepts and to increasingly question its very validity. The biologist, Christiane Nüsslein-Volhard, had to realize during her experiments about the development of the embryo of the fruit fly, that the genes evolving from the fusion of female and male genetic material do not put forth the future organism «all by themselves», but that they require different «gene activations» (NÜSSLEIN-VOLHARD 1996: 45; cmp.: RIEPPEL 1992 and DEUTSCH 1994: 7), which come 'from the outside' for all intents and purposes. During the makeup of the front-back-polarity as well as the above-below-differentiation of the embryo, the fact arises that the essential impulses for this fundamental structuring process stem from 'morphogenic' substances outside the field of the «mother organism» (NÜSSLEIN-VOLHARD 1996: 45).

«Three maternal signals» could be identified. Literally it says: «The signal, coming from the outside, that [initiates] the development of embryonic patterns along» the back and front, experiences specific changes, «and the thus created information moves then, conveyed by a system of trailing proteins, from one compartment into a different one, from the outside to the inside» (ibid: 44). Morphogenesis therefore occurs as a process, leading from the super-ordinated whole to smaller sub-area—in other words, it is not additive starting from the detail. It appears that this process receives essential impulses, of whatever kind, 'from the outside' and is not able to exclusively organize itself from the inside.

The central expression through which the question of the development of life and order, of structures and patterns, has been addressed and discussed during the last ten years, is that of 'self-organization.' In his book «Chaos and Order» (1988: 225), the biochemist Friedrich CRAMER writes that in the past, one had assumed that «there was a life force, an acting world soul, God's hand, entelechy» (*en* – in, *telos* – goal), in the sense of principle coming from the outside, or an intrinsic goal or purpose to existence. Whereas today it is much more in vogue «to trace back natural phenomena to physical forces or substantial structures.» According to this approach the American biologist Stuart KAUFFMAN (1996: 111ff.) starts with the premise, «that life crystallizes almost inevitably in sufficiently complex molecular mixtures,' that life could possibly be a predictable, emergent characteristic of matter and energy.»

According to this point of view, the biologist Andreas Deutsch, likes to compare the single cells of an organism with the «instruments of an orchestra,» that only «have to sound at the right time as well as the right place», so that «the harmonious impression of the whole organism may develop» (DEUTSCH 1994: VII). What is surprising about this 'sound-body-being' is «that even the largest master orchestras seem to be able to do without a conductor» (ibid: VIII). Even without the score being available «in written down notes» –these being comparable to the genetic program– everything seems to develop out of a free «improvisation» (ibid: VIII) (e.g. without a composer). «At the most, the harmonies, in the form of genes, seem to be given to the musicians to use» (ibid: VIII)—a remarkable statement in this context, especially as the origin of those harmonies remains unanswered.

The biologist Brian Goodwin deals with this fundamental phenomenon of nature which he calls «robust morphogenesis» (GOODWIN 1997: 168), that principle of formation which resists arbitrary, random mutation and has endured over millions of years of developmental history. For example, one of these «typical forms» is the periodic «repetition of the pattern of the vertebrae» (ibid: 164), or in algae and higher plants, the rhythmic principle of formation of growth knots (Figure 115, Page 100). «Why is the whorl such a constant element of the system... What is the cause for the stability

Figure 115 – Development of vortices in horsetails.

of this basic form?» (ibid: 172). As a further example of the «evolution of typical forms» (ibid: 181) he mentions the geometric «basic patterns of leaf placement» (ibid: 183) on the stem of a plant. Especially remarkable is the placement of leaves in the form of a spiral, in which «every leaf is shifted relative to the previous one by a constant angle of divergence» (ibid: 184), which, «independent of the species, only assumes a few specific values, of which 137.5 degrees is the most common» (ibid: 185). This angle matches exactly the so-called 'golden angle' which is directly derived from the proportions of the 'golden cut' or the 'golden mean ratio.' It is a surprising fact that the golden mean has only recently gained such prominence in contemporary books on morphogenesis, despite the fact that this principle of nature had been known since antiquity. For quite some time it had hardly been mentioned in the natural science literature at all, and on that rare occasion, it was only mentioned as a curiosity.

For Goodwin it becomes more and more obvious, that «organisms… are not apparatuses of accidentally-put-together building blocks nor are they the result of the unsystematic tinkering of natural selection.» They are mirroring «a profound pattern of orderly relations; But from where does this order originate?» (ibid: 169). Even if Goodwin is of the opinion that for each species there is a kind of «shape space,» that being «according to specific principles, an organized space of possible blueprints» (ibid: 175), the simulation experiments which he describes show that this «shape space» generates itself, in his opinion, simply out of the antagonistic interaction of mechanical and chemical forces. Furthermore, his concept of a «morphogenetic field» is based only on physical aspects (ibid: 186).[9]

Even if Brian Goodwin is of the opinion that the «leaf placements as observed in nature…are typical forms that emerge from a self-organized, robust morphogenetic process» and that plants create «this aspect of their own form simply» by «doing something that comes by itself» (ibid: 203)—the question remains, why is it just this pattern based on the principle of the golden cut that 'comes by itself,' and does it really only result from the interaction of physical and chemical forces that compete for space, nutrition and air circulation.

Maybe a closer look into the principle of the golden mean can help with the clarification of this question. The golden cut is a «very special proportion» that achieves the ratio of «steady division» (DEUTSCH 1994: 67): The

[9] In order to discover the secrets of plants, he focused on the leaf development in the meristem—the undifferentiated, embryonic plant tissue in the innermost part of the leaf and blossom buds—that he, together with other biologists, considers an «excitable medium» (p. 189) and within which he assumes there exists a «morphogenetic field» (p. 186). But as Goodwin defines this 'field' only «through the mechanical tension in the surface layer made up of epidermis cells» (p. 186), he reduces it to merely physical dimensions. How formation is interpreted as a cumulative, or sequential process, is made even more prominent in the description of the same process by Friedrich Cramer: «Each growth can be seen as a phenomenon of internal competition. Specific activators or growth factors allow a specific element or a bud to grow. This growth is, on the other hand, inhibited by competing processes in the vicinity. This can happen through natural inhibitors from the metabolism at the point of growth or by the competition for the nutrients required by the growth» (CRAMER 1989: 197).

Figure 116 – The seeds of a pine cone (left) are arranged in a spiral form governed by the 'golden mean.' The sunflower (middle) follows the same principle. 'Standing wave' (top right), 52.4 Hertz.

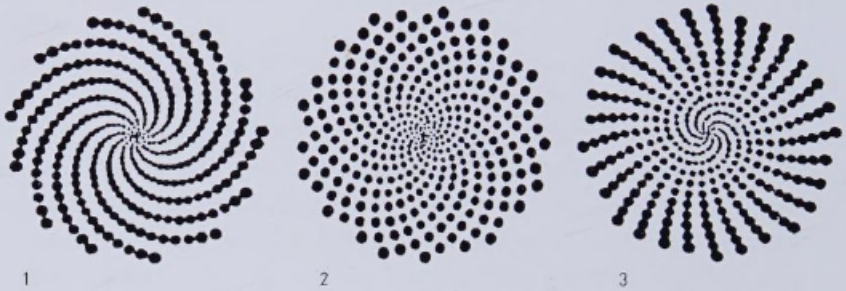


Figure 117 – Right: The typical pattern of two opposing spirals (the pine cone has 13 counter-clockwise and 8 clockwise) only develops in the computer simulation as seen in Figure 2, when precisely adhering to the 'golden angle' of 137.5 degrees. At 136.5 degrees form 1 develops and at 138 degrees form 3 (from DEUTSCH 1994).

whole to the bigger part has the same ratio as the bigger to the smaller part. [The Golden Cut is the one point that will divide a line into segments where the ratio of the larger section to the smaller section is the same as the ratio of the entire line to the larger section.] We are dealing here with a very unique and special ratio between the whole and a part, that is to say a principle of division and formation, in which the whole is always somehow present in a part and thus remains active and thus is not lost by the division (DOCZI 1987: 14, 27). The phenomenon of the golden cut or the «divine division» shows, as E. BINDES (1980: 89) expresses, «that there is a segmenting from…the whole, which carries the image of the whole undetachedly within itself, yet which makes the grace and power of the whole stand out even more through the act of separation.» In other words: The golden cut is a division ratio—which is also a rhythmic ratio—in which the resonance to the whole always remains intact.

Similar to the number π, which is connected to the secrets of the circle, the number that results from the division ratio of the golden cut is one of the «most irrational» (CRAMER 1988: 201) numbers. This means that within them there is a number dynamic that is withdrawn from the grasp of the rational mind because it is connected to infinity in a very special way and thus remains unfathomable (DOCZI 1987: 18). They have something «to do with chaos» (CRAMER 1988: 201), with an opposite of unambiguous, firmly set borders or frozen order. Friedrich Cramer writes: «In describing complex dynamic systems, the chaos expands with increasing non-linearity. In the end very few curves remain as separating lines between areas of chaos, and these shrink eventually to the very last. A connection to the golden cut…can be established. Again, we see a hint of the harmony on the border between order and chaos? The most irrational paths, meaning those that are built according to the ratio of the golden cut, have the

greatest chances for survival in case of a disturbance. They can resist the intrusion of chaos the longest» (ibid: 201). But, on the other hand, should it not be added that these 'paths' can best resist the danger of petrification; that all structures emerging from this number ratio will protect the element of form from total solidification, keeping the border permeable with the whole—extending the individual into the infinite, and thus always remaining in the equilibrium of life? It was expressed this way by Novalis (1957, I: 470): «An infinitely characterized individual is an infinitum.» [Translator's note: an invented word, which could be interpreted a 'single infinity'—like an atom of infinity, the smallest unit of infinity].

The golden mean could perhaps be the ratio, the structuring and formation dynamic, curve, line, rule—plainly the oscillating rhythm between chaos and order, between the whole and the part, the finite and the infinite, the universal and the individual, code and signature of what we call 'life.' Does this unique principle really evolve solely out of a 'self-organization' of parts, or does it accrue more from the whole, or is it even only born out of a dialog between the two, because the whole sees itself mirrored in the part and the part wants to participate in the whole?

In his book «The Numbers of Nature» the mathematician Ian STEWART (1998: 102) develops the issue of 'self-organization' in the following way: «Each understanding of nature has to include an understanding of these prevalent patterns. It needs to explain why they are so widespread and why so many different aspects of nature exhibit the same patterns.... There must be a common principle that is hidden behind these patterns.» Stewart's answer to this is the principle of «symmetry calculation» (ibid: 103). What does 'symmetry' mean in this context, and how can we understand the term 'calculation'? Stewart explains the principle of symmetry with the example of a calm, smooth surface of a pond. Such an «ideal mathematical surface includes many symmetries: every location is identical with every other» (ibid: 50). He continues: «The symmetry of the pond is so broad... that we don't perceive it as a pattern. Instead we consider it a meaningless uniformity» (ibid: 103)[10] which is always present «when the parts don't have an inclination to differentiate themselves from each other» (ibid: 103). In this view one could see the concept of 'symmetry' with its 'uniformity' as a type of physical-mathematical counterpoint to the philosophical expression of unity, the 'One' or the «not-unfolded totality» of Hegel.

Ian Stewart explains the calculation of the symmetry with the event of a stone being thrown into the pond, and the typical developing wave patterns thereupon. «Waves on the surface of the pond are examples of broken symmetry» (ibid: 96). But why do patterns develop, why «not a structureless disarray, in which all symmetries are broken?» (ibid: 105)—and here he gives a very revealing explanation: «The pebble breaks the symmetry of the surface in a way that, after it has set the pond in motion, many of its symmetries have been lost—but not all, and that is exactly the reason why we observe the patterns» (ibid: 96)

Does not, therefore, each occurring pattern contain a memory of the original, a memory of the broken and lost wholeness—this now disturbed unity manifesting as asymmetry. Is not the pattern itself an individual moment of this wholeness, that still carries something of its quality within, revealing it in its structures? «Looked at from this angle,» explains Ian Stewart, «the symmetries observable in nature are fragments of the grand universal symmetries of our...universe.... But something might remain from the real symmetry, and if this is so, then we see a pattern» (ibid: 106). Can we not see the phenomenon of resonance everywhere in the background, the resonating and sounding of the whole within the individual part, the echo-character of each partial oscillation?

Expressions like 'symmetry,' 'breaking of symmetry,' and 'excitability of a medium,' play an important role in the concepts of 'self-organization' (cmp. DEUTSCH 1994). The following process can be illustrated in a simplified way. A rather stable, uniform equilibrium (symmetry), which did not lose its principle 'excitability' and thus its openness for change, experiences a 'disturbance' through an impulse of whatever kind (breaking of

[10] Compare MAYER-KUCKUK 1989: 13: «A totally symmetric world would indeed be mostly structureless. The more complex the structures become, the lower their symmetry generally is. Breaking symmetry and the occurrence of order therefore go hand in hand.»

symmetry). This causes a change to the previous system at which point a new, relatively stable order of higher complexity arises. According to the model of self-organization this 'disturbance' causes self-regulating and organizing processes, through which the system structures itself without an external superior «control program» (ibid: VIII).

Could we not also develop a different understanding of the principle of 'disturbance' out of this? Namely, in the sense that it causes a 'concussion' within the prior equilibrium of the system, through which a continued stay in the previous state of rest and balance becomes impossible, but which creates through this an 'openness' (ibid: 227) to new impulses, that carry within the potential for new formation.

Did HEGEL not say that it is just this «jolting of spatial existence» caused by this concussion disturbing the «quiet material form,» which bares another level which he describes as «having a soul» (HEGEL 1986, 15: 173, 134)? But what could «having a soul» mean in this context? C.G. Jung (1973: 150f) once described the expression 'soul' as «embodiment of relation.» Could therefore 'having a soul' suggest something like an awakened condition of raised inner openness, receptivity, addressability, «impressibility» (SCHWENK), a higher ability to touch, to move, to understand, to relate—or just a willingness or ability to resonate? But what for, towards what?

To clarify the breadth and importance of this question, here is an excerpt from W. HOGREBE'S book «Predication and Genesis» (1989: 106), in which the author considers 'self-organization.' Here he quotes H. Haken. «In all processes of open systems, as for example cloud formation, flows, etc., the same spectacle can always be recognized–how the separate parts organize themselves as if driven by an invisible hand–and how, conversely, the separate systems, through their cooperation, create this invisible hand. This invisible hand, which orders and arranges everything, we want to call the 'steward' [in German: *Ordner*, a person that makes and keeps order] (H. Haken). And because this steward is not something that intervenes in the affairs from the outside, but is instead a part of the system that organizes itself, it represents a regulating principle of self-organization, which by obeying specific rules, 'transforms' chaotic conditions into orderly states.» Subsequently, Hogrebe explains the role of the 'steward' with thoughts and expressions of F. Schelling, that instantly clarify the central meaning of «having a soul» (Hegel): «That, which in natural processes, cares about, that stewards, or can even play a role, Schelling calls «soul-type beings.» But this expression only stands for something that indicates a 'susceptibility' [receptivity] to unity, because such a 'susceptibility' is a prerequisite for the self-organization of nature. This 'susceptibility' sees to it that every natural outfit remains, in its own way, oriented towards unity by the steward, an orientation that Schelling calls «the yearning of nature» (ibid: 108).

If this 'susceptibility to unity' is the 'prerequisite for the self-organization of nature,' then this can only mean that, for one, it is only 'prerequisite' on the part of the medium, but does not yet contain the whole of the process. It is not yet the fulfillment, and that for the completion, the content (in this case the principles of formation and organization) for which the 'susceptibility' is just that—ready, open, susceptible—must come from somewhere else, from a different level of reality, maybe even 'from the outside.'

The shapes and patterns of natural structures and formations like clouds and waves, as well as individual, organic, living beings, display patterns of 'unity' such as uniformity, coherence, and harmony of their inner structure, because these nature-forms and creatures are not closed off within themselves being only 'monologically' self-centered, but are instead 'open systems,' an echo, an individualized reflection of the grand 'unity' from which, ultimately, the principle of uniformity, coherence and harmony is derived. Or again, as STEWART posited (1998: 106), «But something might remain from the real symmetry, and if this is so, then we see a pattern.»

Following these examinations of self-organization, let us now consider the effects of oscillations in connection with formation processes, in the following ways. Should these oscillation impulses be interpreted as the 'disturbance' or the impetus that causes the spontaneous self-organizing processes in an open system, resulting in the appearance of order or structure? Do these oscillation impulses function as the energy source, awak-

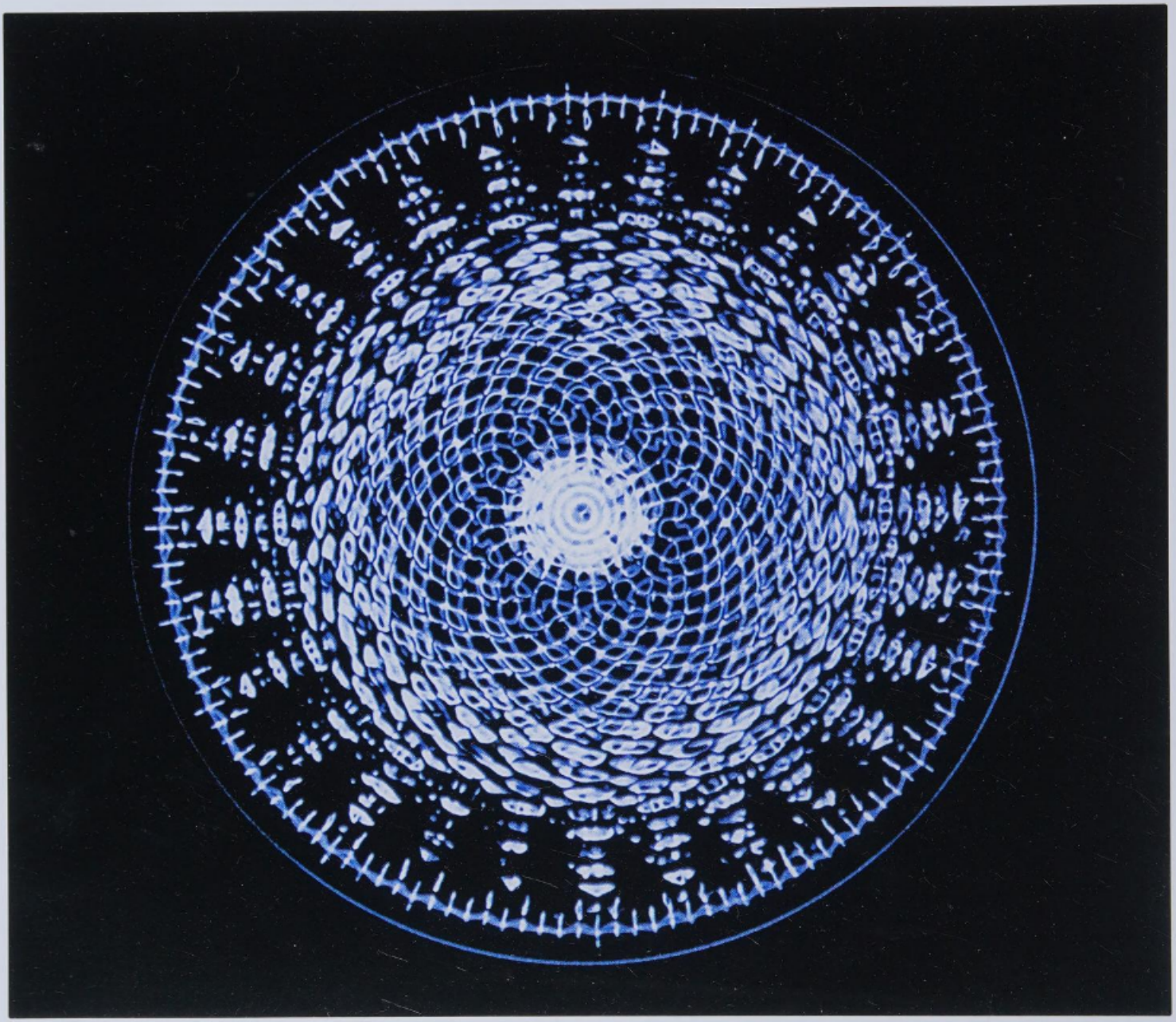


Figure 118 – 'Standing wave' 102.58 Hertz.

ening structures that are implicit in the substances themselves and in their physical and chemical characteristics, thereby helping them to realize themselves? Or do the oscillation impulses, their rhythms and intervals contain intrinsic formative principles which are impressed upon the more passive matter and substance by this oscillation until a pattern appears? Or do the oscillations and their energy only serve to transfer 'encoded' structures and programs of external origin to the substances, and thus shape them in this way?

Looking at the current collection of phenomena and views we have been considering, couldn't we also imagine the following assumption? The patterns and formations that appear are the result of a 'dispute' and a meeting between the momentum of the oscillation and the principles of formation and order contained within it, and the momentum of the substance with its particular material characteristic (mass, size, specific weight, elasticity, temperature, etc.). These material characteristics represent certain conditions in relation to the impinging oscillation impulses, conditions that can either be revealing and approaching, or more closed and resistant. Depending on these particular characteristics, the oscillation might be modified, disturbed, or even completely extinguished. Resonance would mean that the material conditions of a substance or object conform so well with the oscillation that it can now create forms and shapes almost unhampered and pure, taking into account the inherent physical conditions of the substance and the ability of the exciting impulse to inspire it. All formation, each form and every pattern of nature, would therefore be an image portraying a single phenomenon delimiting itself against the whole, thus individualizing, and then again conducting itself towards it. And finally we must ask, which aspect of the «grand universal symmetries» (STEWART) is reflected and expressed in its fragments, and with what unambiguousness?

«The force is the infinite vowel, the substance the consonant.»

(NOVALIS 1957, I: 260)

«Should the bodies and figures be the nouns—the forces the verbs—and the natural sciences—the art of deciphering.»

(NOVALIS 1957: 151f.)

In this view, is not the 'susceptibility to unity' exactly the state that is caused by the 'disturbance'–which is now suddenly unveiled as a liberating development, because the 'shock' means tearing out of inert and solidified conditions, a letting go of antiquated and hardened forms of existence and a move towards willingness for dialog and communication through the whole, towards a resonance with the 'unity'? Is this not the real 'yearning of nature,' the drive and motivation of all evolution and metamorphosis, to reach, through an openness to change, towards realization of ever new, successful resonances through ever newer, more communicative and freer relations?

«But then all of the sudden
the great heartbeat breaks into us secretly,
so that we scream –
and so we become, change and revelation.»

(RILKE, 1976: 136)

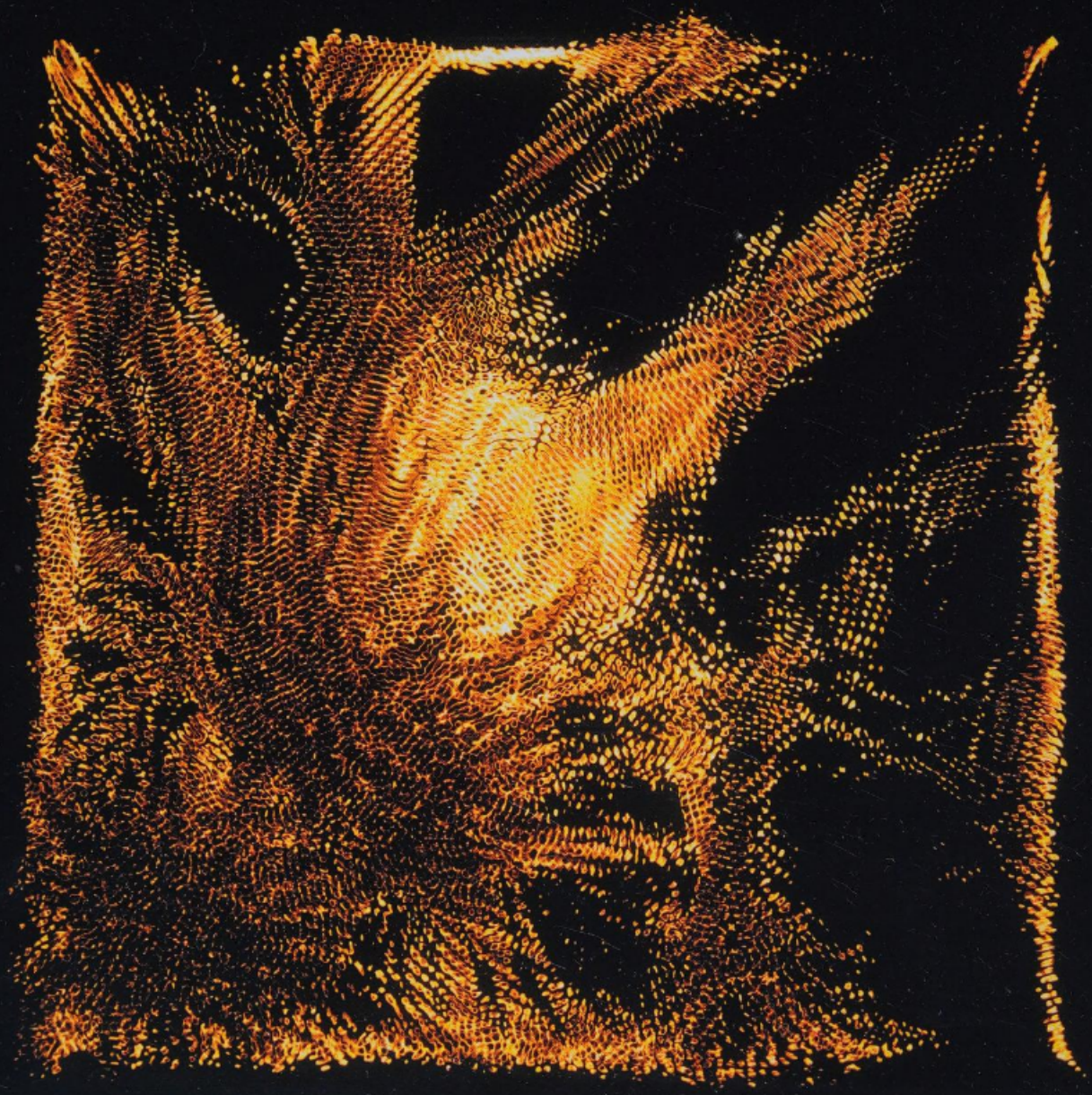


Figure 119 - Japanese flute, shakuhachi.

«The Music

Say, where do you come from?

From everywhere.

Say, where will you go?

Into the wide world.

Say, where is your origin?

In life.

Say, where will you end?

In my beginning.

You are shaped by your past,

Your being is already future.

Say, what is your present?

My music.»

(Sibylle SCHNEIDER, Kreuzlingen, In dialog with the river Thur)

All of the formation phenomena we've examined so far, essentially resulted from applying a sustained oscillation of constant frequency (sine wave). When music acts upon water, the formation processes develop a totally new quality and dynamic. It is fascinating to experience how quickly the sensitive water responds with wave structures to the incessant flow of tones, almost as if it were alive. How easily can it be moved by the simultaneous sounding of different instruments with their harmonics, conjuring an inexhaustible fullness of multifaceted forms, patterns and images. The lower notes allow larger wave structures to develop in this 'water music,' which are, perpetually overlaid by the faster, more delicate waves of the higher notes. But since the whole water surface is not always in resonance with the full frequency spectrum, dark fields of calm water appear in changing locations, just to be grabbed and penetrated by the dynamic of the waves the next moment. [11]

[11] Naturally the type and form of the perimeter of the container used has an effect on the development of the pattern, as the waves—depending on the shape of the container—are reflected differently at the borders and therefore different overlay structures develop. Therefore various container shapes were used, corresponding to the different musical pieces in order to more clearly develop the sound images. The choice of color filter for the light source was attuned according to subjective considerations regarding the sound 'color' of the piece. Especially with the complex wave structures of music and its high dynamic, the observation could consistently be made, that there were times, often correlated with weather changes in the atmosphere, in which the disposition of the water to 'participate' appeared impaired, just as if it were 'inert' or sluggish. The change of the surface tension through electrostatic charge in the air might have influenced the responsiveness of the water to the oscillations, immensely.

«The spindle turns on the knees of Necessity; and on the upper surface of each circle is a siren, who goes around with them, chanting a single tone or note. The eight together form one harmony; and round about, at equal intervals, there is another band, three in number, each sitting upon her throne: these are the Fates, daughters of Necessity, who are clothed in white robes and have chaplets upon their heads, Lachesis and Clotho and Atropos, who accompany with their voices the harmony of the sirens—Lachesis singing of the past, Clotho of the present, Atropos of the future; Clotho from time to time assisting with a touch of her right hand the revolution of the outer circle of the whorl or spindle, and Atropos with her left hand touching and guiding the inner ones, and Lachesis laying hold of either in turn, first with one hand and then with the other.»

(PLATO, The Republic [Politeia], German version 1993, 422)

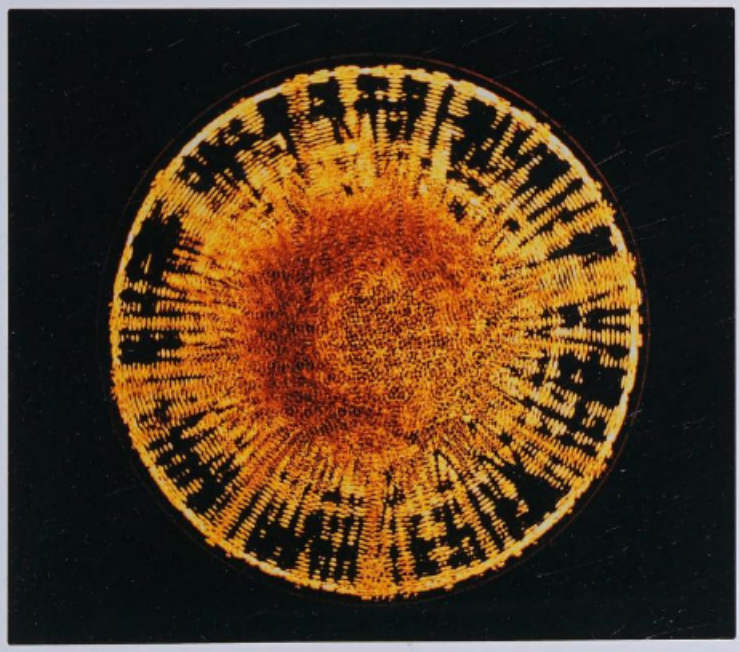
▸ Figure 120 - Monochord.

Water Sound Images Created by Music

▲ ▶ Figure 121, 122 - Overtone singing and monochord.

Pythagoras «directs... by virtue of his ineffable and nearly incomprehensible sacred ability, his hearing and his mind towards the sublime harmony of the world. Therefore, he alone heard and understood—as he explained it—the total harmony and singing of the spheres and stars moving within. This harmony resulted in a more perfect and fulfilled music than anything earthly, because out of the unequal and diverse tempos, volumes and durations of sounds that are nevertheless attuned in clear and musical proportions, movement and orbit are formed simultaneously—sonorous and unutterably beautiful in their colorfulness. Of this music he allows himself to be saturated, ordering his mind in these pure relationships and exercising within himself—just as an athlete trains his body. Of this, he intended to give his disciples as accurate a copy as possible, by imitating this spherical music with instruments, or with just his voice. And he believed, that only he, amongst all earthly, could hear and understand these universal sounds, and he considered himself worthy to learn something directly from the natural source and origin, to make it all his own and attain likelihood to the heavenly worlds by emulating and simulating them, as he alone has been so fortunately equipped by the Divine that created him with such sufficient organs.»

(Lambichos about Pythagoras; quote after SCHAVERNOCH 1981:38f.)



«As it moves about, there's music without ceasing.

In heavenly tones, pours out a who-knows-how,

And while it moves, all's turned to melody now.

The pillared shafts, even the tri-glyph, ringing

I believe that the whole temple's singing.»

(J.W. v. GOETHE, Faustus II, verse 6444)

◂ ▸ Figure 123, 124, 125 - Overtone singing and monochord.

«Look how the floor of heaven

Is thick inlaid with patinas of bright gold:

There's not the smallest orb which thou behold'st

But in his motion like an angel sings,

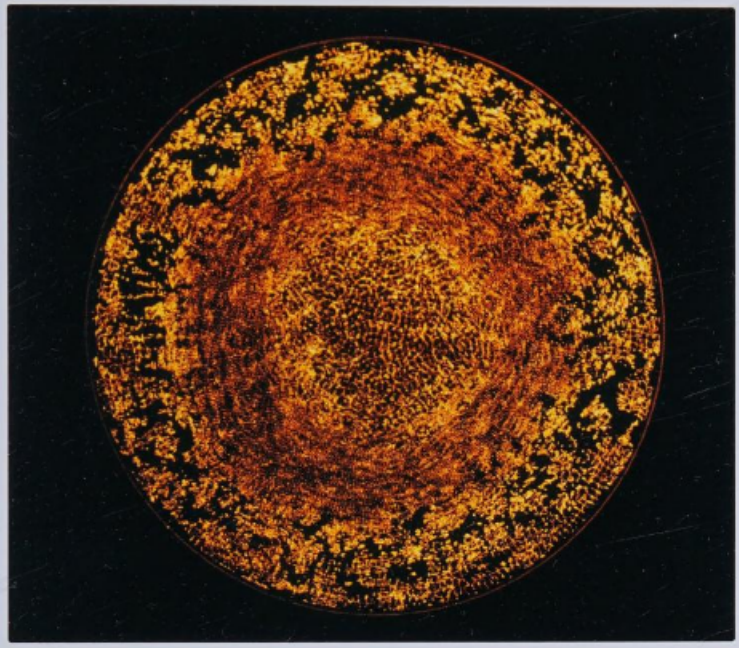
Still quiring to the young-eyed cherubim;

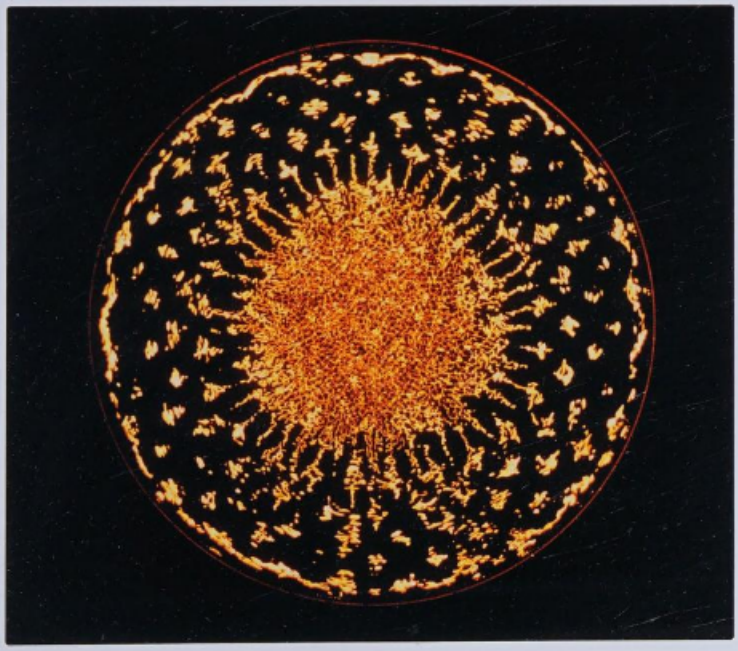
Such harmony is in immortal souls;

But whilst this muddy vesture of decay

Doth grossly close it in, we cannot hear it.»

(William Shakespeare, The Merchant of Venice)





«Music and rhythm. The hexameter in periods—large scale. Large rhythm. Whose head became home of this large rhythm, the inner poetic mechanism; who will write, beautifully, magically, without intentional participation. And so it appears—while the highest thoughts join with those strange oscillations and approach each other in the richest and most diverse of orders—the deeper meaning of the ancient saga of the miracles of musical art as the mysterious teachings about music as shaper and mitigator of the universe. Here we take a deep and learned look into the acoustic nature of the soul and find a new similarity of light and thought—as both become brothers of oscillations.»

(NOVALIS, Fragments I, 1957: 351f)

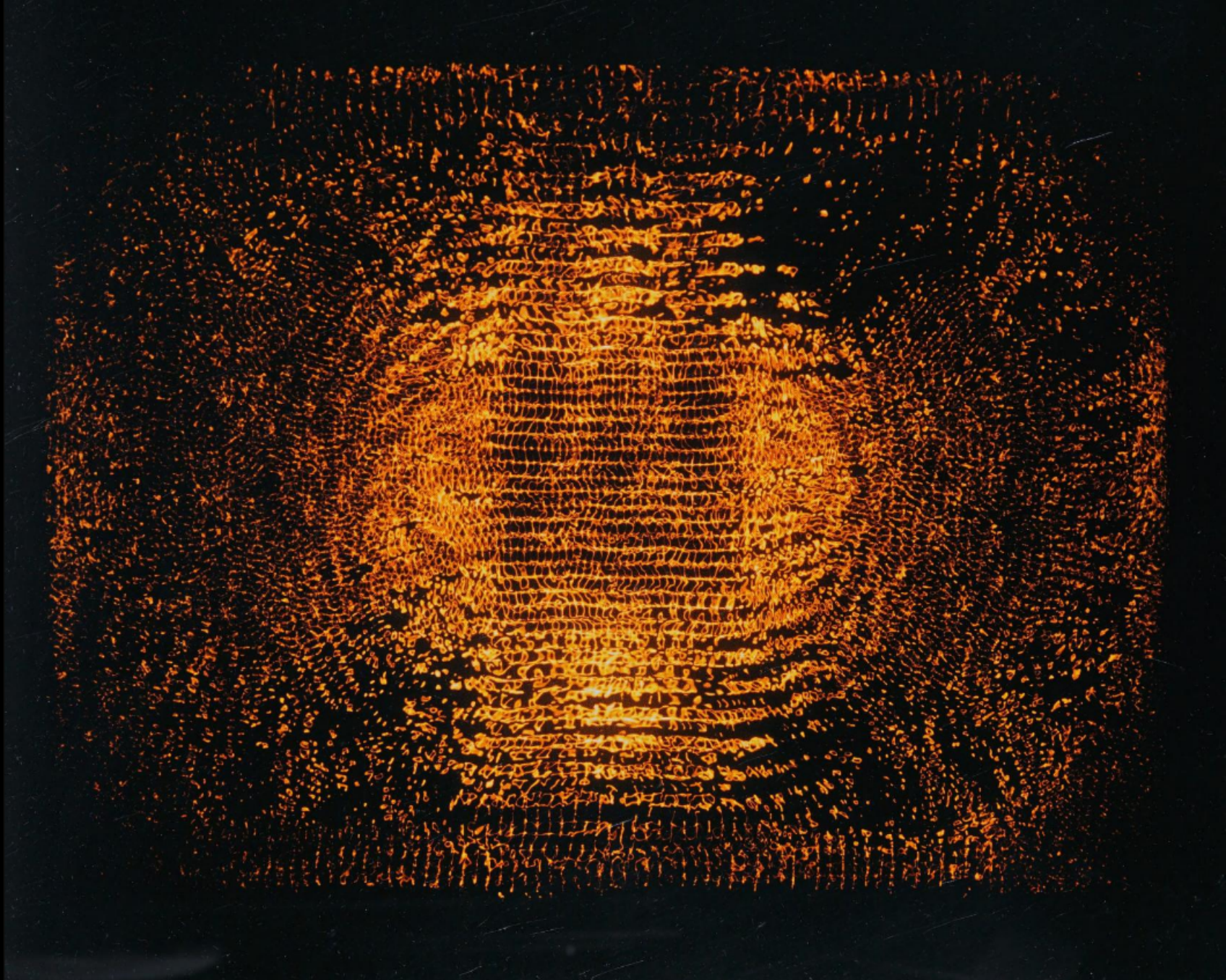
«When from Asia's mountains the sacred moonlight
enters and the stars meet in your wake,
you glow in celestial brilliance, and so—as they
stroll—you see waters change and the song of
brothers above resounds, the night melody,
in your loving bosom.»

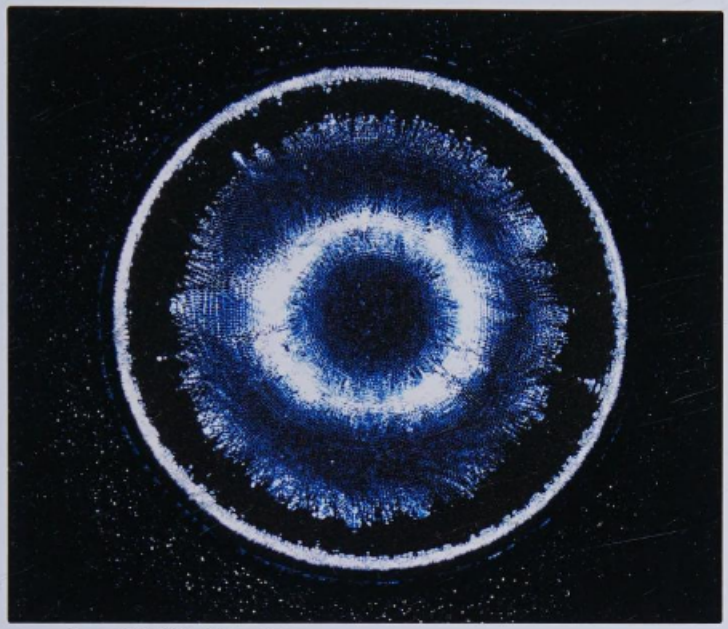
(Friedrich HÖLDERLIN, The Archipelagus, 1981: 177)

«... thus music brings into view the form of movement
of celestial bodies, the pure form, freed from object
and matter, as its very rhythm and harmony. Music is
that art which has shed physicalness the most,
by presenting pure movement as such, removed
from any object, and by being carried by invisible,
almost spiritual wings.»

(F.W.J. SCHELLING, Philosophy of Art, 1985,II: 330)

▸ Figure 126 - Rheingold Overture, Richard Wagner.





◂ ▴ Figure 127, 128 - Didgeridoo.

«As beings, the great ancestors where limitless and unbound, immaterial, vibrational substances, similar to energy fields. They created by extracting vibrational energy out of themselves and solidified this energy by defining and naming it—the inner name is the potential of the form or the being. A comparable notion is the creation of sounds, words or songs from the vibrations of breath. The aborigines therefore say, that in the dreamtime-creation the world has been sung into life.»

(Robert LAWLOR, Voices of the First Day, 1993)

«Didgeridoos, sometimes called drone pipes, were known to the northern tribes. During their spread into the south, the type changed with the availability of appropriate woods.

In tropical regions the natives used bamboo, while the southern tribes used branches that were hollowed by termites. For completion the pipes were filled with hot charcoal, by which the resonance canal was formed.

The playing of the didgeridoo requires extraordinary concentration. A skilled musician uses his cheeks as an air reservoir and blows the air into the didgeridoo to play the music, while simultaneously breathing in through his nose to fill the lungs. The didgeridoo is only used to play the music for dances. These instruments are highly regarded as their fabrication requires much time and great diligence.»

(Ross LE CRAS, The Teaching Stones of a Disappeared Tribe, 1988: 132)

◂ ▴ Figure 129, 130 - Didgeridoo.

«GONG

Not anymore for the ear.... Sound,

which, as a deeper ear,

hears us, who appear to hear.

Reversal of spaces. Design

of inner worlds in the open....

temple before their birth,

solution, saturated with

insoluble gods.... Gong!

Sum of the mute,

confessing to itself,

roaring self-comtemplation

of that which falls silent,

permanence, pressed from a flow of events,

re-cast star.... Gong!

You, who are never forgotten,

born out of it's own loss,

no longer understood celebration,

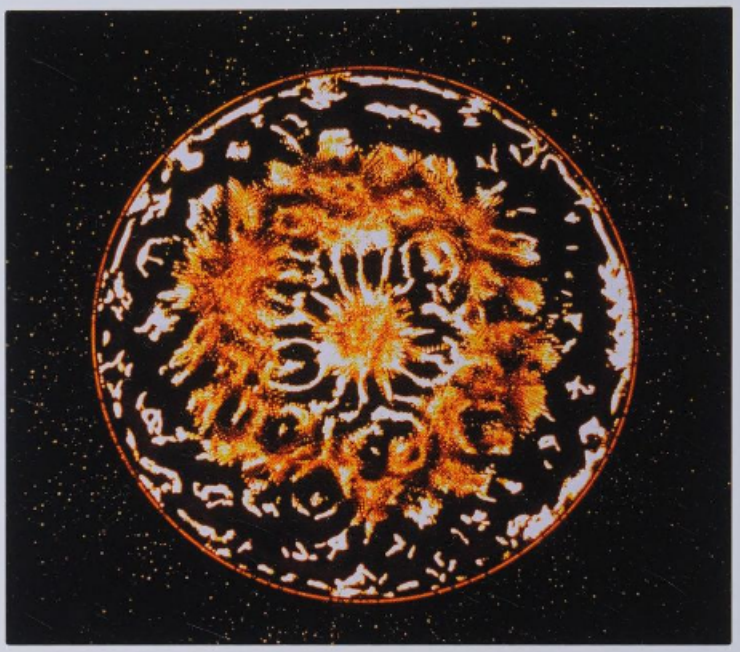
wine touching the invisible mouth,

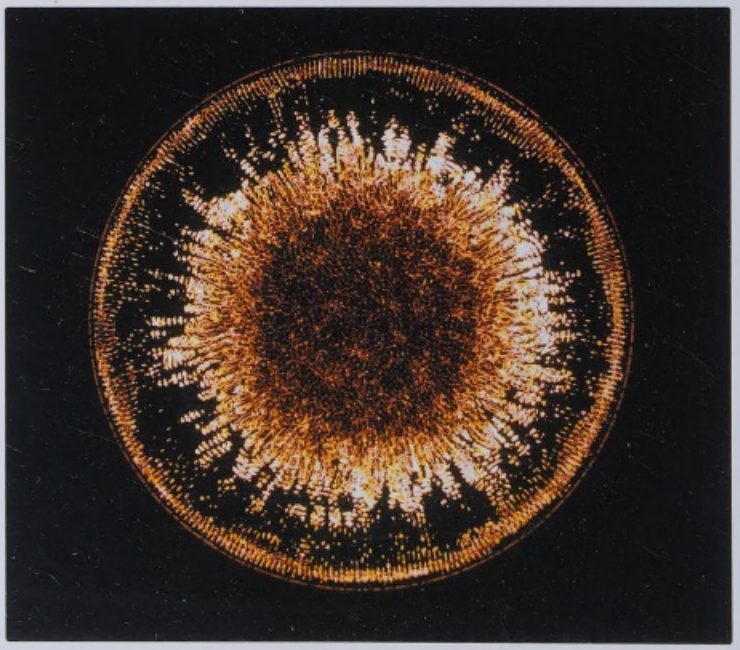
storm in the column that bears,

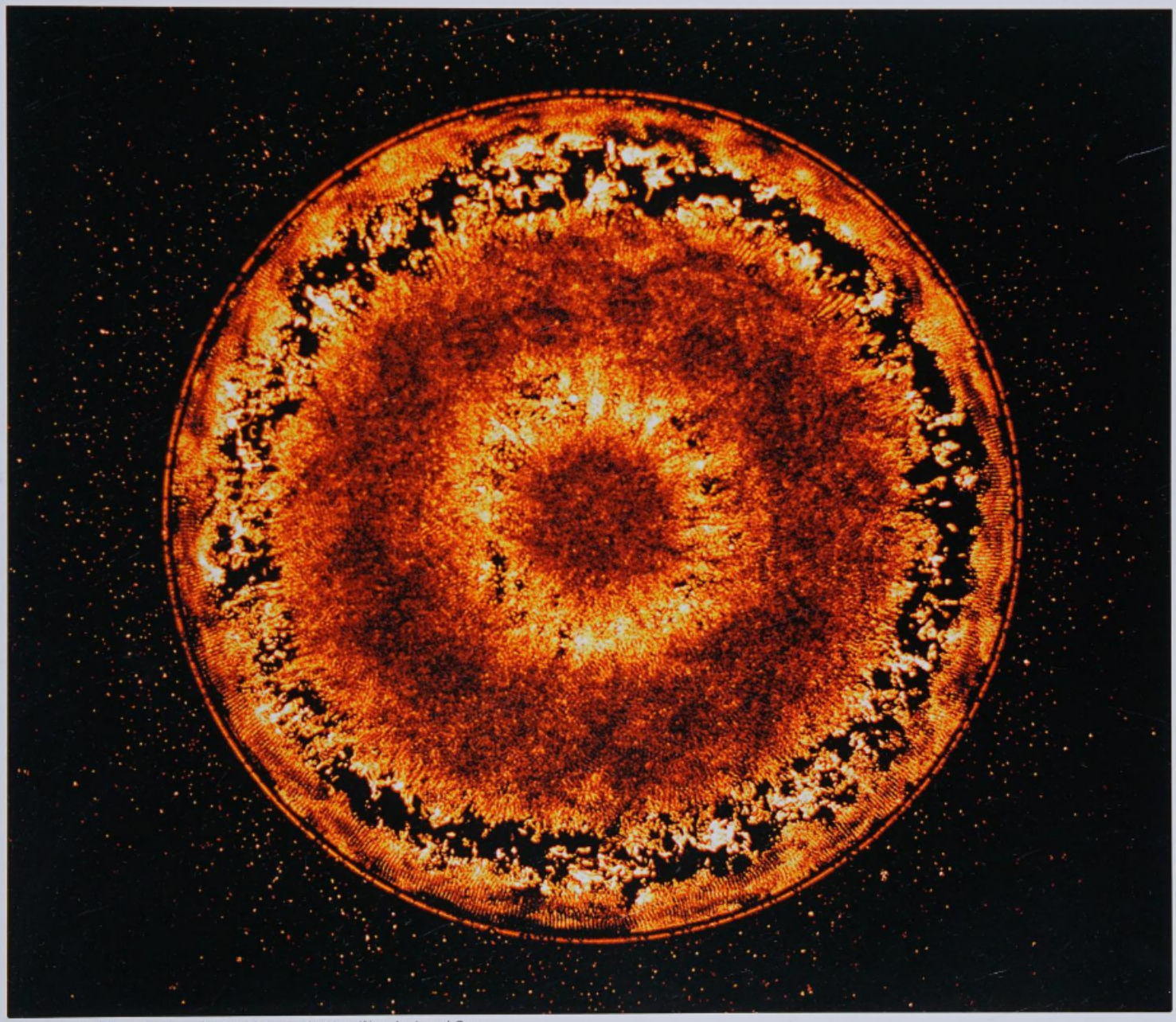
wanderers fall onto the path,

our treason, against everything.... Gong!»

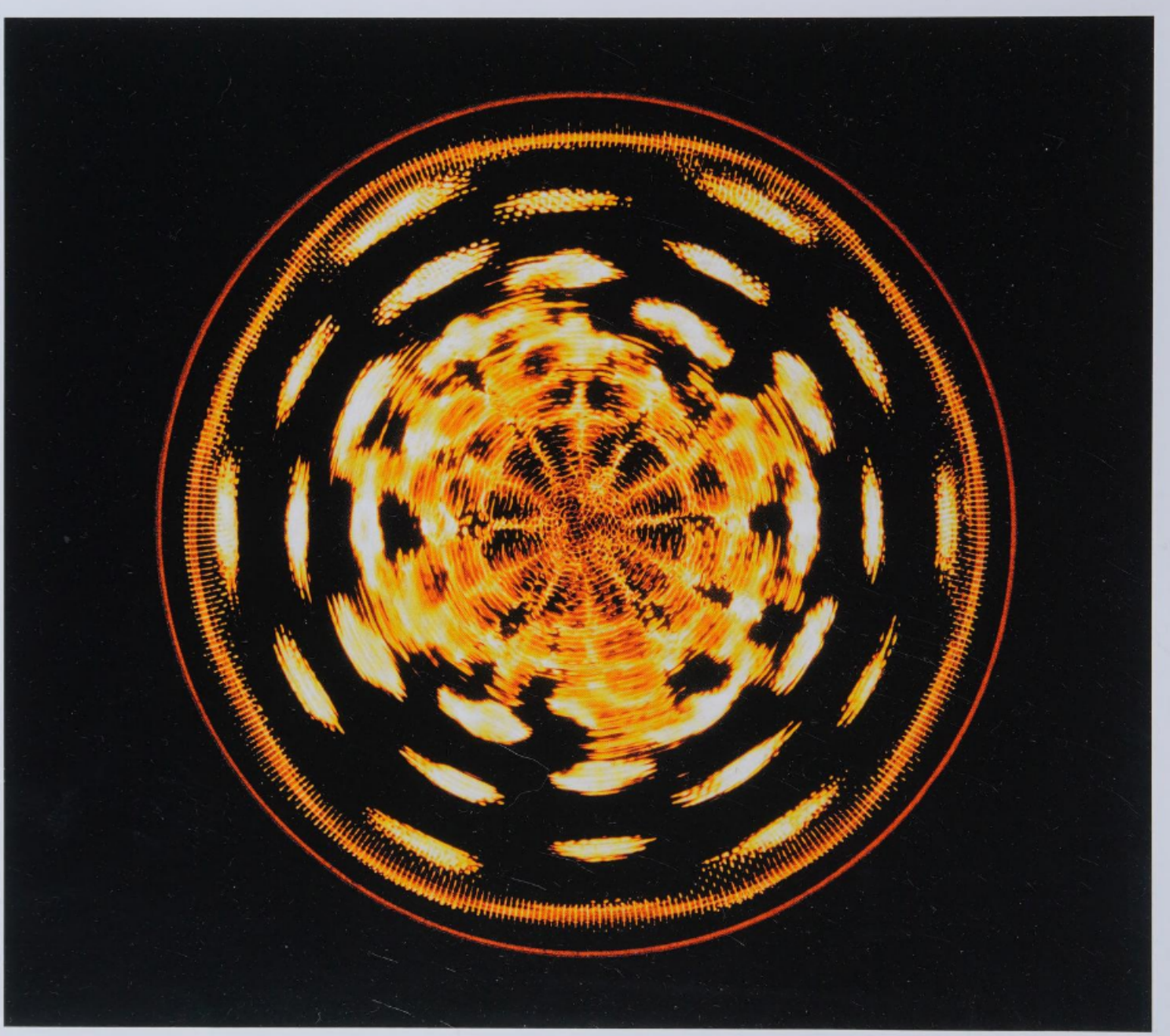
(Rainer Maria RILKE, Marooned on the Mountains of the Heart, 1976a: 174)

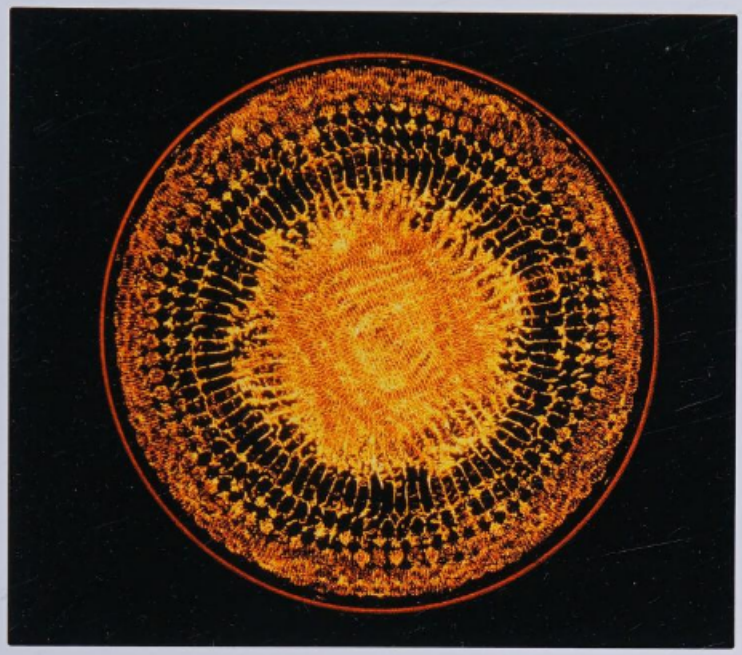


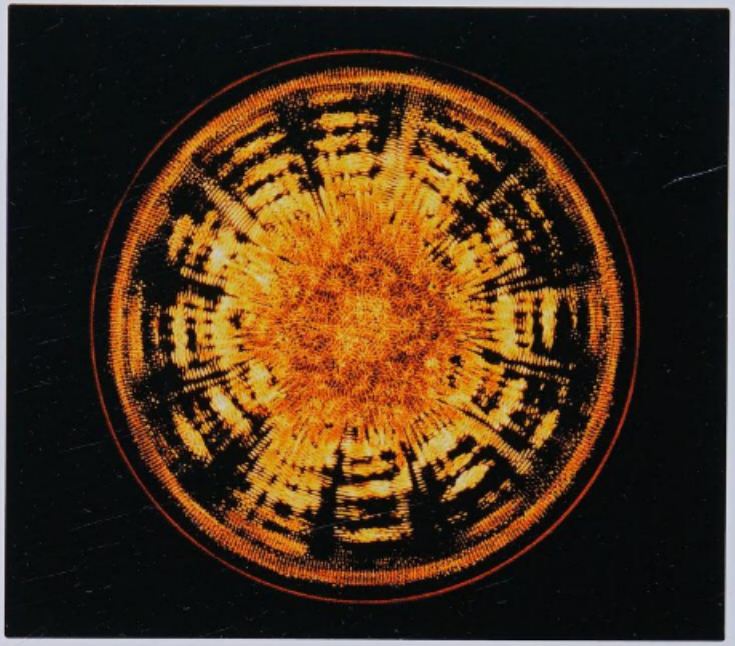




◂ ▴ Figure 129, 130, 131 - Gongs, «Neue Horizonte» (New horizons) Duo.







◂ ▴ ▾ Figure 132, 133, 134, 135 - Gongs A.L.

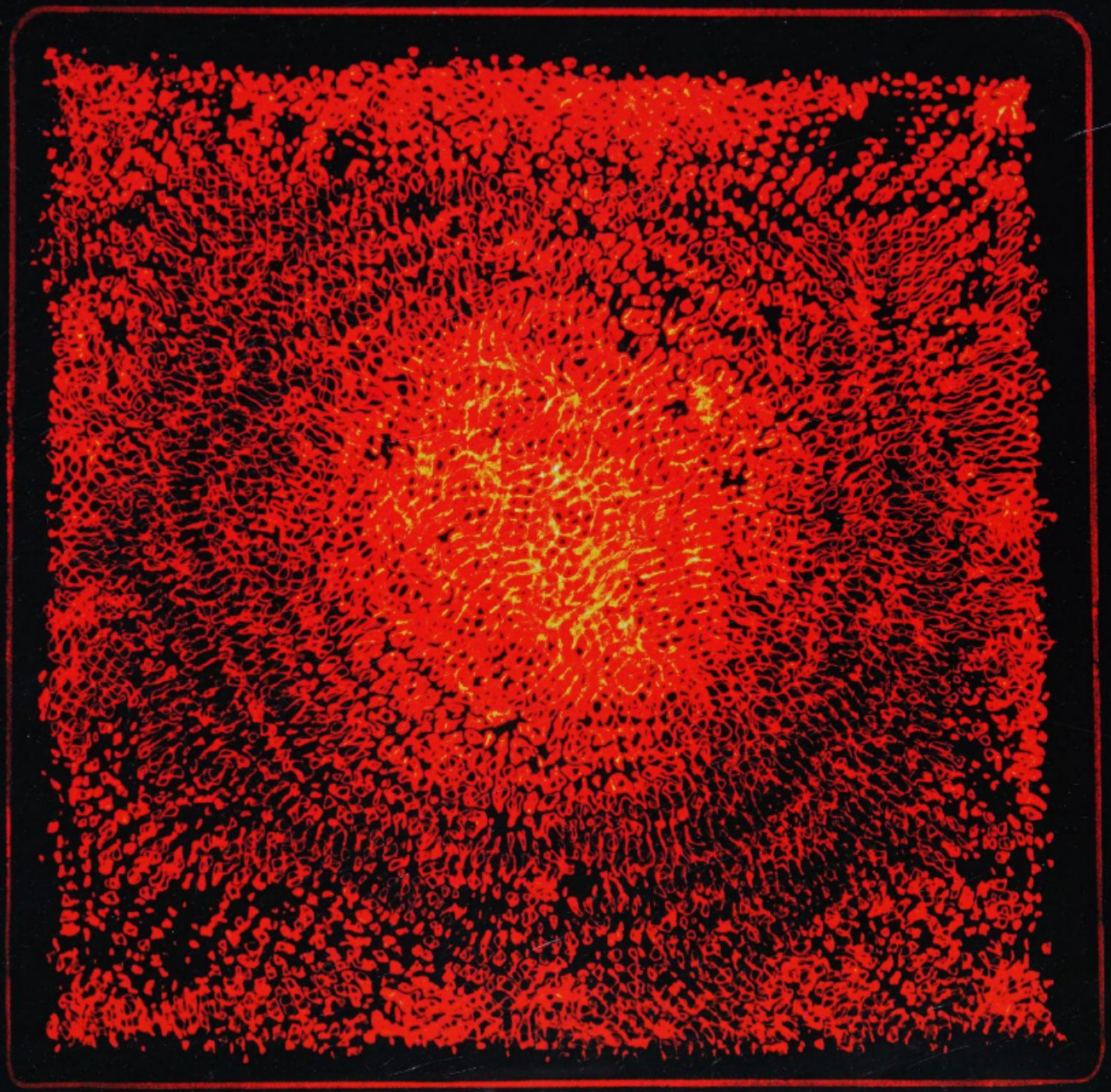
▸ Figure 136 - Tibetan Monks chanting.

«Tibetan Buddhism regards man not as a solitary figure but always in connection with, and contrasted against, a universal background. In the same way, Tibetan ritual music is not concerned with the emotions and with temporal individuality, but with the ever-present, timeless qualities of universal life, in which our personal joys and sorrows do not exist, so that we feel in communion with the very source of reality in the deepest core of our being. To bring us in touch with this realm is the very purpose of meditation as well as of Tibetan ritual music, which is built upon the deepest vibrations that an instrument or the human voice can produce: sounds that seem to come from the very womb of the earth or from the depth of space, like rolling thunder—the mantric sounds of nature, which symbolize the creative vibrations of the universe, the origin of all things. They form the foundation as well as the background from which the modulations of the higher voices and the plaintive notes of the reed instruments arise like the forms of sentient life from the elemental forces of nature—which are nowhere more apparent than in the gigantic mountain ranges and in the vast, lonely highlands of Tibet.

Just as the bass-voice of the precantor forms the basis of the choir, from which the liturgy starts and to which it sinks back in a peculiarly sliding way at the end of each part of the recitation, in the same way the huge twelve-foot radongs form the basis and the starting-point of the orchestral music. They are always in pairs, and are alternately blown in such a way that the sound of one merges into the other without breaking their continuity, while at the same time producing the effect of gradually swelling and ebbing tides of an ocean of sound. And on the surface of this ocean the breeze of individual life creates and plays with a multitude of waves and wavelets which, like the high-pitched tremolo of the oboes, add vivacity and melody to the vastness of the ocean, whose sound seems to be that of the all-embracing OM, the prototype of all mantric sounds.

It is in imitation of this sound that mantras are recited in that peculiar, deep bass-voice with which the Umdzé begins and conducts the liturgy. The liturgy, after all, is mainly mantric in character, especially in the opening and closing passages of each section.... In contrast to the more or less static sound of the radongs, the bass drums and the big cymbals introduce a dynamic element into the orchestra. Not only does the rhythm change according to the metre of the recitations, but—what is more important from the musical and emotional point of view, as it creates a feeling of liberation and a release from the slowly mounting tension—towards the end of each section the rhythm is accelerated until it merges into one great finale, in which the big cymbals, by a peculiar rotating movement, produce a triumphantly up-surging sound, rising above the thundering rumble of the bass drums, and ending in a mighty clash. After this, a new, slow rhythm marks the beginning of another section of the liturgy.»

(Lama Anagarika GOVINDA, The Way of the White Cloud, 1968:29f.)



«Nordheim the Ready asked the Master of the Yellow Earth saying, 'Your majesty, enact the music of the celestial harmony in the regions of the Dung-Ting lake. When I heard the first movement I became afraid, when I heard the second movement I was exhausted, when I heard the last movement I was confused. Inexpressible feelings of infinity arose in me and I lost myself.'

The ruler spoke: 'You could not feel any other way. I made this music with earthly means but showed the heavenly. I ordered their movement according to the rules of art and gave it the form of great purity. The highest music is foremost equivalent to human dealings; it adjusts to the rules of heaven. It changes according to the different forms of existence and corresponds to freedom. Then it orders the seasons and brings harmony to all creation. The seasons occur in sequence and the creatures arise in their course. The change from flowering to wilting is signified by peaceful and then martial sounds. First pure, then murky, they show the harmonies of the light and dark force of the world. Their tone is as flowing luster. The larvae of the insects start to stir; I give them a start with thunder and lightning. The end is not indicated by a conclusion; the beginning has no introduction. First death, then life; first she seems to end, then she starts over again. That which is eternal and inexhaustible can not be expressed by a song. Therefore you became afraid.

In the second movement, my music follows the harmony of the light and dark primordial force. In it I placed the glow, the luster of sun and moon. Therefore their tempos could be once short, once long, and once strong. They changed and shifted but still remained in the same key. There was no ruling theme, so it became an eternal melody. It filled the valleys, it filled the chasms, it nursed the longing, it preserved the spirit, it gave meaning to all things. Its sounds trailed away broadly, its tone was high and clear. Therefore spirits and ghosts were its secrecy. Sun, moon and stars changed their path. I gave them their firm limits through finiteness. I let them flow through the never-ending. You wanted to comprehend them but you could not grasp; you looked for it but you could see nothing; you followed it, but you could not reach. So you became overwhelmed on the way to nothingness. You leaned on your lute and hummed. Your eyesight tired when you desired to look. As I remained unreachable to you, you could only keep your outer form, but the inner was void. You were like the shed shell of a cicada, and you were exhausted. In the third movement my music created sounds that did not allow for exhaustion. I tuned it to the laws of freedom. Therefore the tones follow each other as bubbling wells, like opulently sprouting plants, like the joys of the forest which are hidden to the eye. It spread with its motions and did not leave any trail. Deep and dawning and without sound, it moved in the beyond and tarried in dark depths. One might deem it to be death, the other to be life; one to be reality, another to be illusion. The tones flowed along, then dissolved. Without a ruling theme it was an eternal melody. The world does not understand this, and must therefore let one who is more qualified judge. The appointed one grasps its emotions and is able to follow its laws. When no invisible drive tenses and still all senses are filled, this is heavenly music. Speechless, the heart feels joy. So spoke the vortex's master in its praise: 'One listens for it and does not hear its sound, one looks for it and does not see its form.' It fills heaven and earth and embraces the whole space. You wanted to hear it and grasped nothing. Therefore you became confused. In the beginning the music caused fear; through the fear you became depressed. Then I let exhaustion follow; through the exhaustion you became lonely. In the end I created confusion; through confusion you felt like a fool. Through the foolishness you become responsive to meaning. Only thus, can you harbor the meaning and become one with it.'»

(DSCHUANG DSI, The True Book of the Southerly Flower Land, 1974; 158f.)

▸ Figure 137 - Japanese flute, shakuhachi.

▸ Figure 138, 139, 140, 141 -
Organ, Olivier Messiaen: *Apparition de l'Église éternelle*.

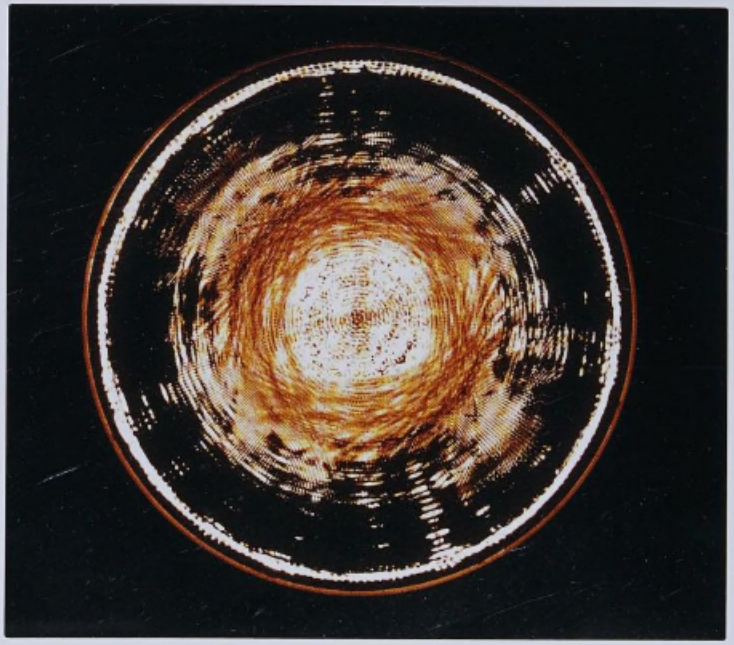
The Organ Play of Heaven

«Master Ki of Südweiler sat contemplating, his head in his hands, leaning over his table. He looked up at the sky and breathed, absent-mindedly, as if he was lost to the world. One of his students, standing before him ready to serve, spoke: 'What is going on? Can one really grow the body still as dry wood and extinguish all thoughts like dead ash? You are so different, master, as I usually see you bent over your table.'

Master Ki spoke: 'It is very good that you inquire about this. Today I buried my ego. Do you know what that means? You might have heard man's organ play, but never listened to earth's organ play. You might have heard earth's organ play, but never listened to heaven's organ play.'

The disciple spoke: 'May I ask how this is possible?'
Master Ki spoke: 'The great nature exhales, one calls it wind. Just now it does not blow; but if it blows, then fiercely all holes resound. Have you never witnessed this roaring? The mountain forests' steep slopes, the hollows and holes of ancient trees: they are like noses, like mouths, like ears; like rings, like mortars, like puddles, like pools of water. Here it sizzles, there it whirrs, it sounds, it wheezes; here it calls, there it wails, here it booms, there it crashes. The initial sound is shrill, followed by panting sounds. When the wind blows there are quiet harmonies, when the tornado arises, there are strong harmonies. When then the terrible storm dies, then all openings stand empty. Have you never seen, when afterwards everything gently resonates and vibrates?'

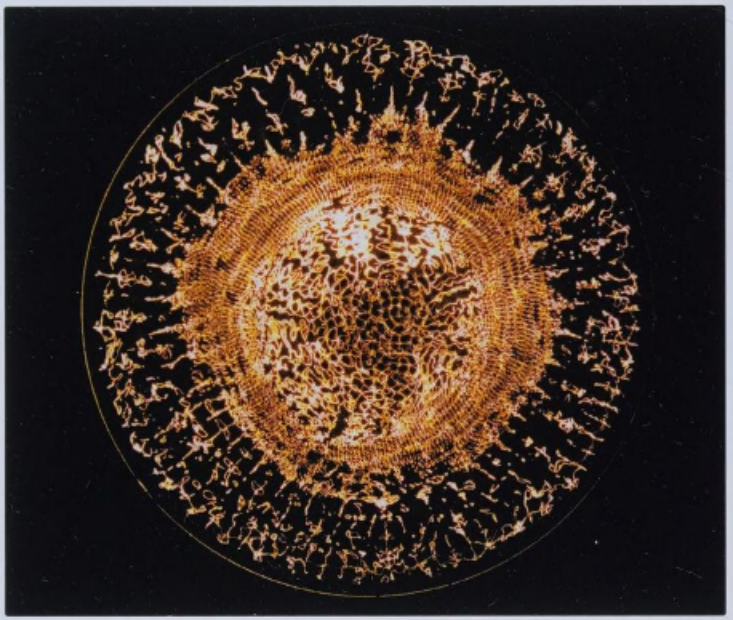
The disciple spoke: 'The earth's organ play thus simply comes out of the different openings, just as man's organ play comes out of lined up rows of pipes. But may I ask, how is heaven's organ play?' Master Ki spoke: 'That blows in thousands of different ways. But behind all this there is a driving force that causes all those sounds to end and that they shall all arise. This driving force: who is it?'»
(DSCHUANG-DSI, The True Book of the Southerly Flower Land, 1974: 39f.)

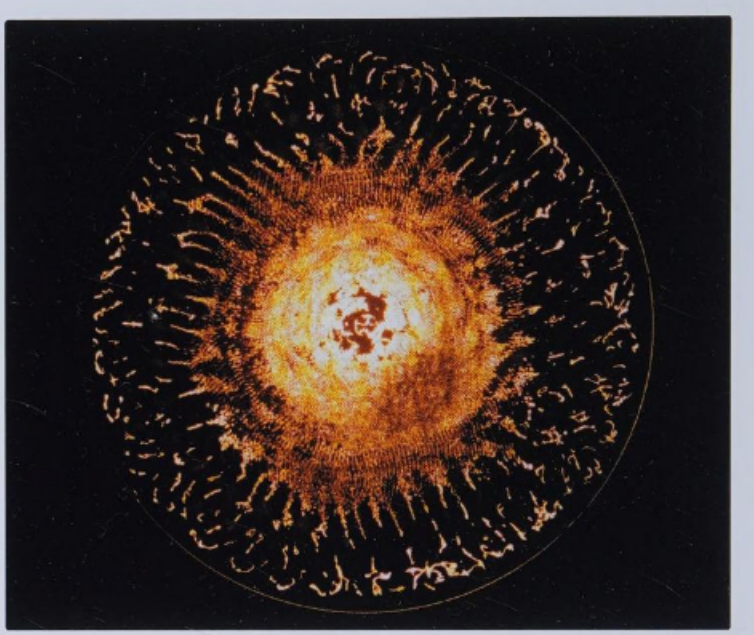


◂ Figure 142 - Light – Water, Karlheinz Stockhausen [well-known German progressive musician].

«Just as light developed with the development of air, thus its opposite developed with the densification of air to water. That is to say, that just as air relates to light, so water relates to sound, to tone. The tone obviously goes through the air and causes it to vibrate, thus becoming audible. But the tone—the tone in itself—developed and appeared on earth parallel to the forming of water. And exactly as the air was penetrated by the effect of light, so then was all water, to which the air has been condensed—as we now have the earth consisting of warmth, air and water—vibrated totally through and through, by sound beams. Our Earth was then most penetrated in those parts by celestial harmonies, by tones that stream onto our earth from space in all different sound harmonics, where it had become watery—and the result of these sound effects in the water is very, very important. Naturally you have to imagine that in this primordial water, in this liquid earth-water, were contained all substances that today are refined as metals, minerals etc. It is particularly interesting to direct one's spiritual view to these ancient times, to see the different forms as being developed out of water, by a sound that created shapes. The sound creates shapes in the water. This was a very magical time in the development of our earth. In the earth's development, some things happened on a larger scale, just like when you sprinkle fine dust onto a metal plate and then stroke it with a violin bow, regular forms appear; the Chladni sound figures. Thus the most diverse shapes and figures are formed by the music streaming in from outer space, and the substances that were dissolved in the water, that had been watery themselves, they obeyed the celestial music and fell in line with the celestial music. And the most important formation of the dance of the substances following the celestial music is the protein, the proto plasma, as it is the basis of all formation of life. Let the materialists contemplate as much as they like about the mechanical composition of protein from oxygen, nitrogen, carbon etc. The original proto plasma, protein, developed out of the world-substance which formed itself out of the harmonies of the celestial music. This protein-like substance, this proto plasma, that permeates everything, thus arranges itself now around and into those delicate objects. Along those lines, that I have described to you as warmth-lines, the water, coagulated to protein through the celestial sound, runs and gradually transforms into hematopoieses—the formation of blood. In the nerve lines the coagulated water institutes itself as the protein formation. At first the protein forms a kind of hull, like a gristly glue substance, one could say, so that there is protection from the outside. All this really forms according to the dance of the substances in following the measures of the celestial music.»

(Rudolf STEINER, The Influence of Spiritual Beings Upon Man, 1984: 89f.)

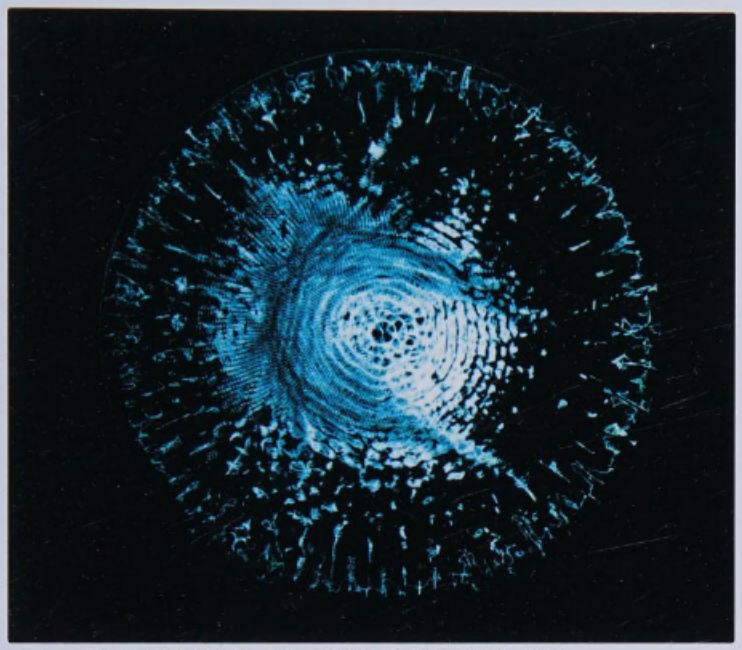


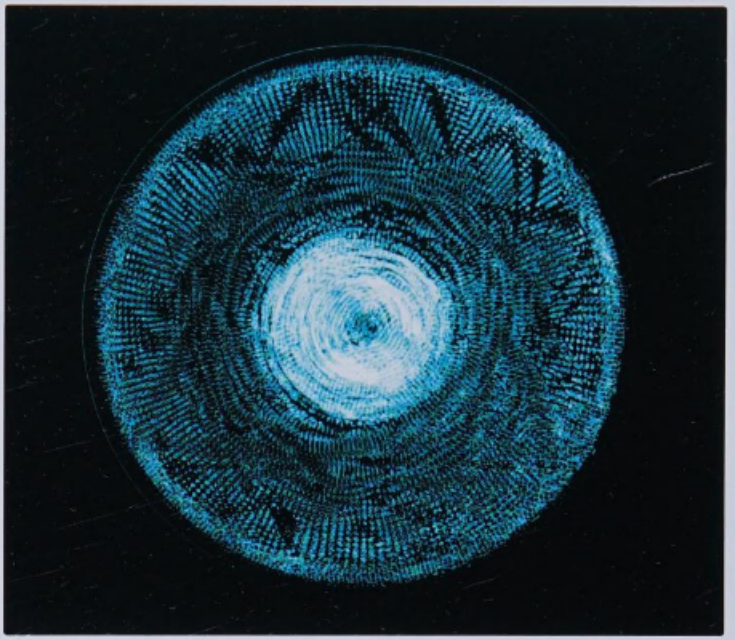


▲ ▶ ▼ Figure 143, 144, 145, 146 - Light—Water, Karlheinz Stockhausen.

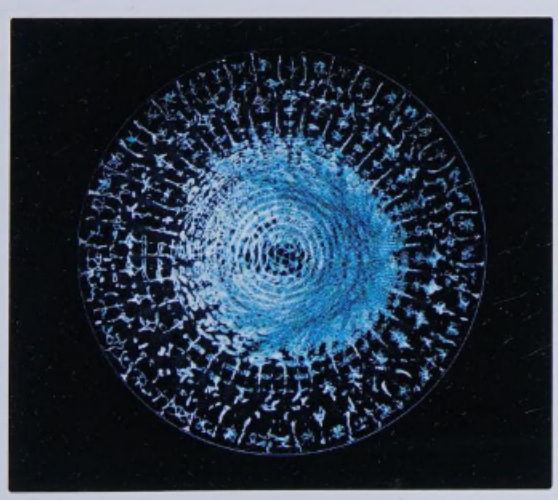
«Permeation of form and music—not only instrumentality.»
«Sound in every form—form in every sound.»

(NOVALIS, Fragments II, 1957: 169f.)



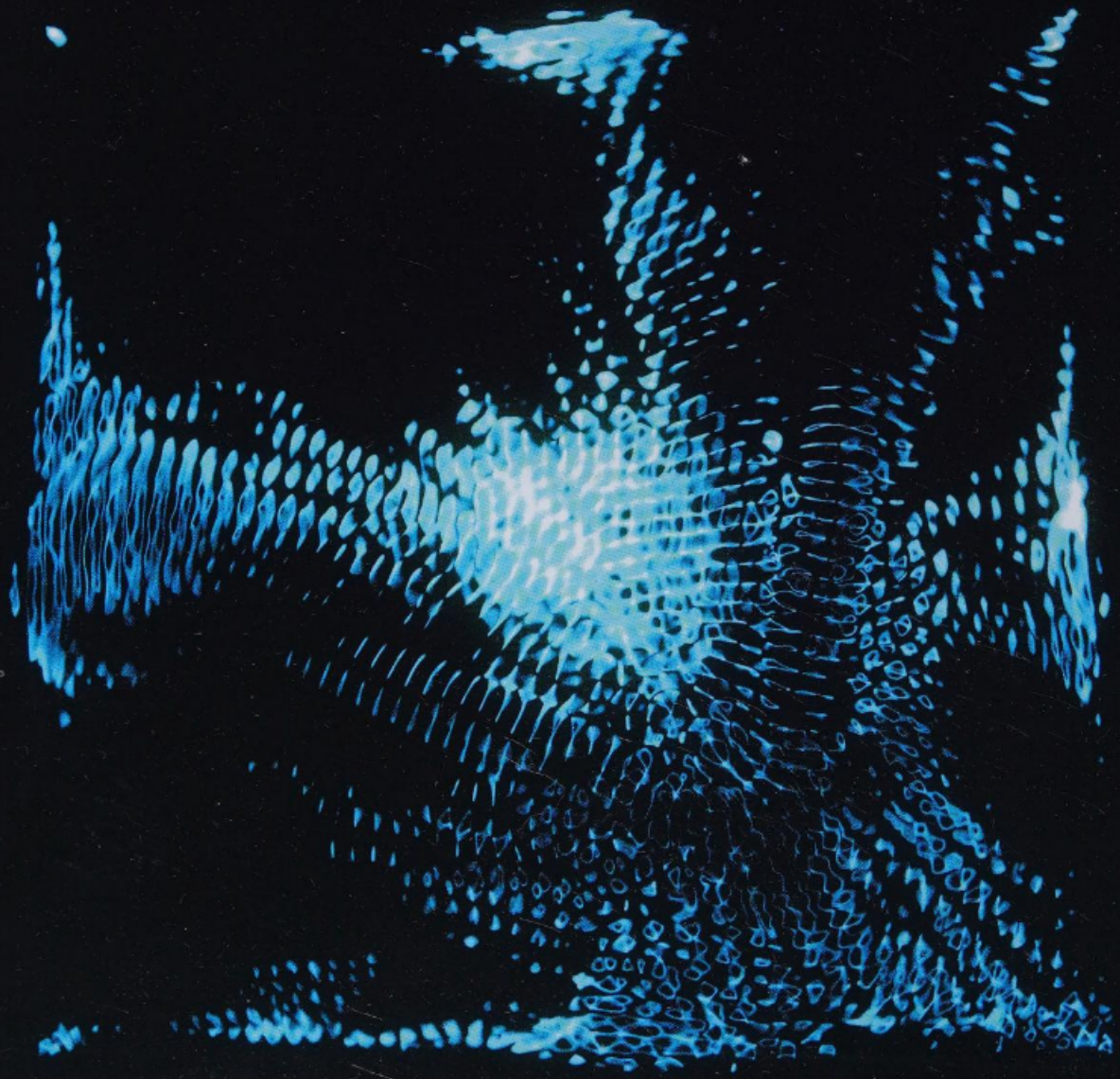


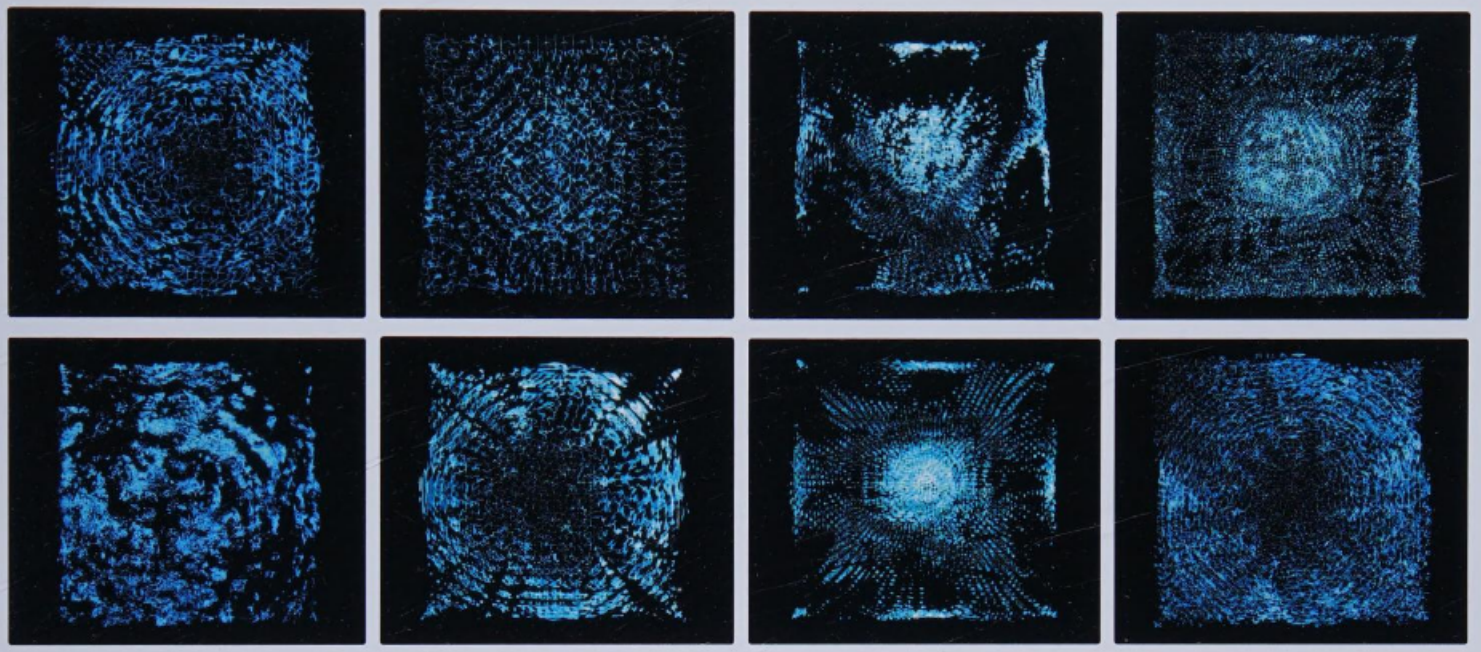
▲ ▶ ▼ Figure 147, 148, 149 - Light—Water, Karlheinz Stockhausen.



«Art training. (Painting) Sculpting thus nothing but figures of music. Strange expression: in highest verve. (Painting) Sculpture—objective music. Music—subjective music or painting. One should oblige everything, to express itself acoustically, to be silhouetted, to be encoded. Fixated movements are lines. The circle emerges from the central vibration of a surface.»

(, Fragments I, 1957: 358)

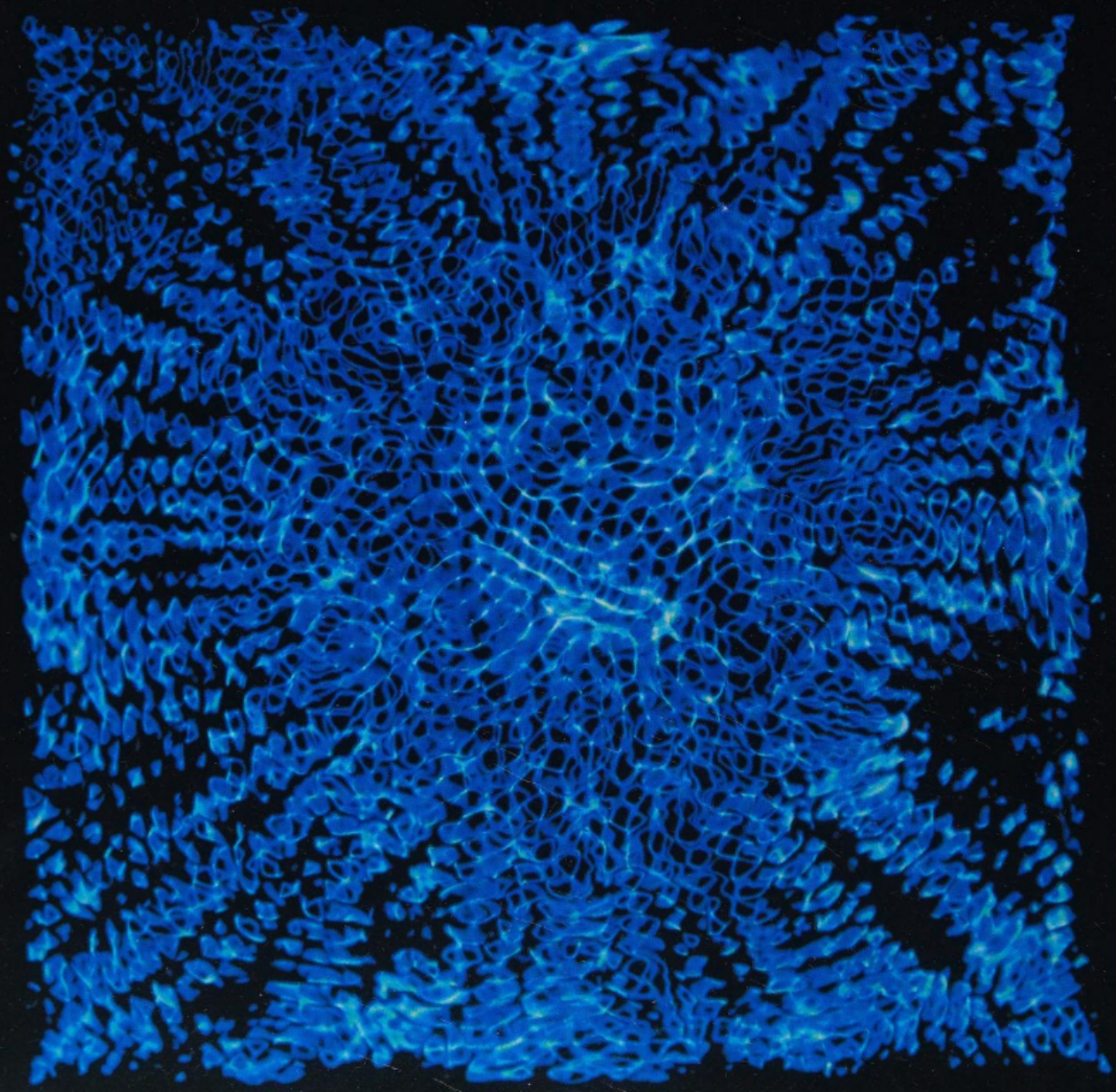




◂ ▴ Figure 150, 151 a-h - Humpback whales songs.

«It was while gliding through these latter waters that one serene and moonlit night, when all the waves rolled by like scrolls of silver; and, by their soft, suffusing seethings, made what seemed a silvery silence, not a solitude: on such a silent night a silvery jet was seen far in advance of the white bubbles at the bow. Lit up by the moon, it looked celestial; seemed some plumed and glittering god uprising from the sea.»

(Herman MELVILLE, Moby Dick, 1977: 317)



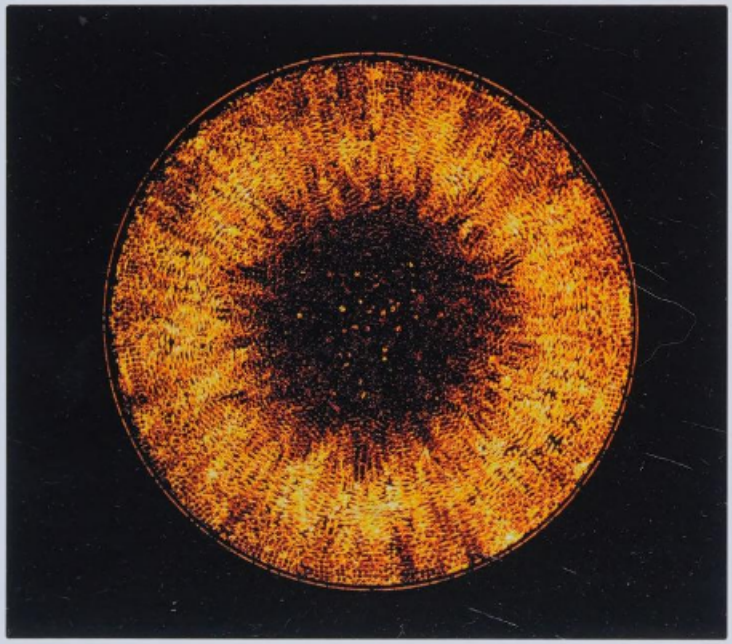
◂ Figure 152 - Humpback whale songs.

«There is, one knows not what sweet mystery about this sea, whose gently awful stirrings seem to speak of some hidden soul beneath; like those fabled undulations of the Ephesian sod over the buried Evangelist St. John. And meet it is, that over these sea-pastures, wide-rolling watery prairies and Potters' Fields of all four continents, the waves should rise and fall, and ebb and flow unceasingly; for here, millions of mixed shades and shadows, drowned dreams, somnambulisms, reveries; all that we call lives and souls, lie dreaming, dreaming, still; tossing like slumberers in their beds; the ever-rolling waves but made so by their restlessness. To any meditative Magian rover, this serene Pacific, once beheld, must ever after be the sea of his adoption. It rolls the midmost waters of the world, the Indian ocean and Atlantic being but its arms. The same waves wash the moles of the new-built Californian towns, but yesterday planted by the recentest race of men, and lave the faded but still gorgeous skirts of Asiatic lands, older than Abraham; while all between float milky-ways of coral isles, and low-lying, endless, unknown Archipelagoes, and the impenetrable Japan. Thus this mysterious, divine Pacific zones the world's whole bulk about; makes all coasts one bay to it; seems the tide-beating heart of earth. Lifted by those eternal swells, you needs must own the seductive god, bowing your head to Pan.»

(Herman MELVILLE, Moby Dick, 1977: 639f.)

«Listen to the flute's song, as it cries
and as it wails, tortured by the pain of separation:
'Since I was cut from my home Röhricht,
the whole world joins in my lament...'

The Mathnawi begins with a poem, that has become a model for thousands of verses in the Persian, Turkish and Indo-Muslim poetry and has also recently inspired one of the leading Arabic poets. It is the *schi 'r-e ney*, the 'Song of the Reed Pipe,' which, cut from the local reed, wails and thereby makes all the world cry. Because its sound reminds the creatures that once they were not disconnected from God, the origin of all being in all eternity, and that only through the act of creation did they come into the world of duality. It is the fire sounding out of the flute, the same fire of love which turns grapes to wine. Thus in Maulana's poem, the pipe becomes both poison and antidote, its songs (*parda*) tear the veil (*parda*), which cloaks for man the memory of an eternal home, and separates him from the Beloved. It knows the tragic love stories that tell about the lover who has to wander the path in blood, and is so likened to the poet, who tries to intimate, in ever new stories and images, the one secret—that of longing for the eternal Beloved which permeates all levels of creation. The pipe may also be seen, in a sense, as the reed pen, giving an account of separation and suffering, when dancing on paper 'without a head' after the divine writer has shaped it. Yet another connection exists between the reed-pipe, the reed-pen and sugar cane, which received its sweetness from the breath of the Beloved and thus proclaims Him.



Rumi himself is the pipe, longing for the breath, the lip of the Beloved, to say what he wants to say—did not God proclaim in the Koran: We do inspire him [Adam] with our breath? (Sura 15/29) and does he not make man into His pipe in a sense? The poet is also a string instrument, touched by joy and made to sing:

Like a harp leaning at his chest I am,
And my wailing comes from the finger of the friend.
Because his veins are like the strings stretched upon the
fragile body,
And sometimes the stroke is too strong for this
weak instrument.
You, at whose bosom of mercy
I resound like a harp—
Strike the plectrum somewhat gentler,
So that the string not break!»

(After Annemarie SCHIMMEL, Maulana Rumi, 1995b: 39, 205ff.)

◂ ▴ Figure 153, 154 - Indian sarod, Ken Zuckermann.

For Maulana the act of creation is the primal sound of divine music; once awakened by the sound of the divine voice, the creations-to-be surge to partake in the whirling dance of the world. In an entrancing *Ghazal* he talks about how he anticipates the call for the Dervish's dance from a 'place that is no place.'

A twig from the heavenly dance becomes

All of dancing here on earth,

And from the dance of the soul

The dances of life seem to be only twigs.

Then he is addressed by God: 'Be!' by which He calls the non-being into being:

Echoes a call in the non-being: there

The non-being says: 'Indeed!

I put my food into this land,

To show myself—glad, green and fresh!'

He hears God's call of times long gone,

Dancing it was and intoxicated;

Non-Being it was and became being—

Hearts and tulip and figs!

Therefore, for Maulana, the Dervish's dance and the music here on earth becomes the refrain of that first loving address by God, or at least it awakens a memory; the Dervish's dance is a window, a ladder towards heaven, to bring him back into the lost paradise of immediacy with God. Do not all dust specks dance within the rays of the sun?

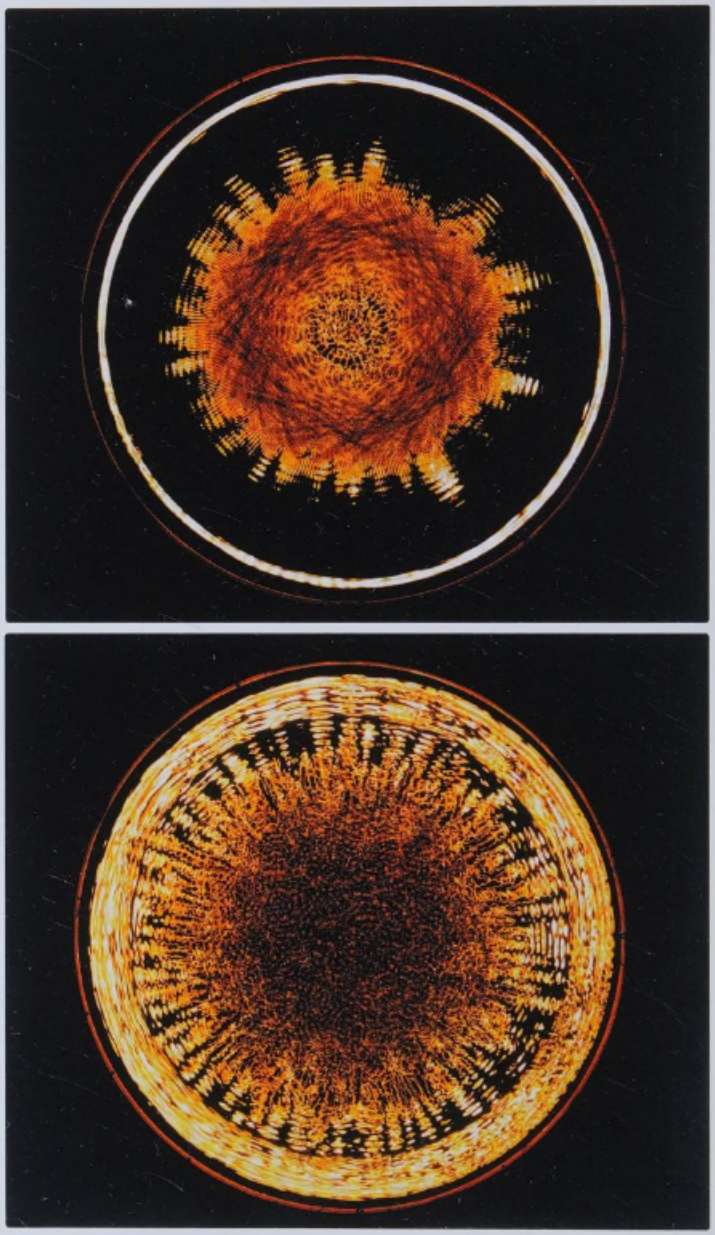


Figure 155, 156 - Sufi Music, Mevlana—Whirling Dervishes, Turkey
[Translator's note: Mevlana was the founder of the Whirling Dervishes.]

Every morning we dance before him like specks of dust
Because this is how sun worshippers are!

Through this dance, the specks of dust (one is inclined to use the modern term 'atom') gain an orientation towards a specific goal. They are taken out of their individual pattern of motion and become, through the circular movement around the center, a new entity, which is animated and sustained by the power of the sun. Because, as contradictory as this phenomena might be, as diverse as the paths of life may be—in the center there is always Divine Love and nothing can fall out of the cosmic order, which embraces everything.

The dance embraces everything. It embodies the secret of life: in distant circles around the central sun, the Divine Love, to un-become, self died off, awakening to higher life. The clothing of the Mevlevi-Dervish indicates this secret: they wear a black coat, symbol of the dark life on earth, over the white dance robe. They keep it on during the three passes before the sheik, exchanging ceremonial greetings. Then the coat is thrown off and in white, the color of the body of resurrection, they whirl around their own axis as well as in larger circles, with one hand opened towards heaven, ready to receive mercy, and the other pointing towards the earth, to pass on mercy. Ancient ideas about the movements of the stars, about the celestial dance, have entered this ritual, which has been interpreted anew, over and over again, and which has inspired the greatest Turkish composers.

A Turkish verse which is sung at the end of the ritual, at the height of rapture, says in a classical wording, that the dance is *ruha gida* 'food for the soul,' nourishment for the spirit. But for the true men of god it is also a 'dance of blood,' just as Halladsch [Translator's Note: al-Halladsch, one of the most famous Persian sufis] danced enchained as he was led to his execution. Because the deepest meaning of the dance is to symbolize the perpetual interchange between life and death, of dying and becoming, as Maulana has expressed it most eloquently in a poem that has been freely interpreted by Rückert:

«Sound, oh drum! Echo, oh flute—Allah hu!

Seethe in dance, morning's dawn—Allah hu!

Light-soul in planets whirl, son, from

The Father raised in its center—Allah hu!

Hearts! Worlds! Your dance would stumble, if

Love within would not command: Allah hu!...

Soul, you will a star to whirl you, around yourself,

Throw away all life's sufferings—Allah hu!

He who knows the power of the dance, lives in God,

As he knows, how love kills.—Allah hu!»

(After Annemarie SCHIMMEL, Rumi, 1995b: 205ff)

«Once our master Jalaluddin spoke thus:

'Music is the creaking of the portal to paradise!'

Thereon one of the brazenly stupid fools spoke:

'I do not like the creaking of portals.'

Thereupon spoke master Dschalaluddin:

'I hear the portals, as they open,

but as the doors close again—

this you hear!'»

(After Annemarie SCHIMMEL, Mystic Dimensions of Islam, 1995b: 261)

«The trees, dressed in dancing robes,

pleading in love

Mevlâna

The image in me

Is another image

In the dance in me

Falling as many stars!

I whirl and whirl

the heavens whirl

Roses blossoming for me to see.

The trees in the sunny garden

'He created heaven, the earth'—

The serpents hark the flute's song

In trees in dancing robes ...

The children of the meadow intoxicated ...

Heart ...

They call you

Smiling I look down upon suns

That lost their way

I,

I fly

the heavens fly»

(ASAF HALET CHELEBI, after Annemarie SCHIMMEL, Mystic Dimensions of Islam, 1995a: 264)

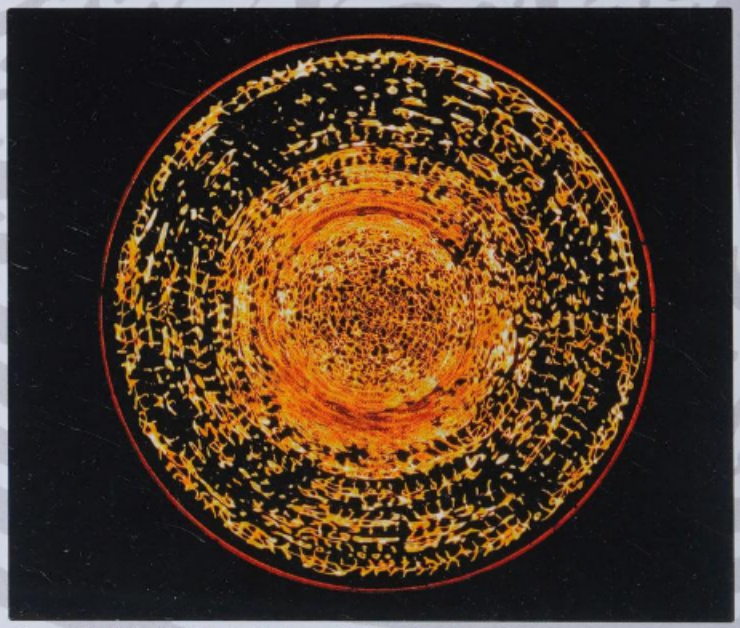


Figure 157, 158 – Sufi Music, Mevlana—Whirling Dervishes, Turkey.

«Sokrates

D'où reviens-tu? –

From where do you come back?

Athikte

Asile, asile, ô mon asile, ô Tourbillon! –

Refuge, refuge, oh my refuge, oh whirl! –

J'étais en toi, ô mouvement, en dehors –

I was in you, oh movement, outside,

de toutes les choses ...

outside of all things...»

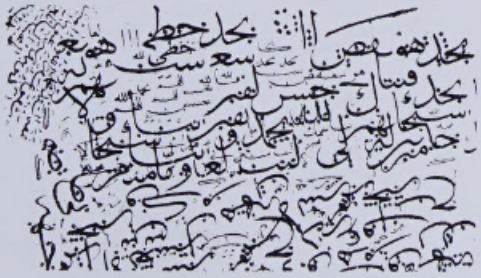
(Paul Valery, *Eupalinos*, 1973: 53)

Figure 159 – Arabic characters (from KHATIBI/SIJELMASSI 1995).

«Psychology. To the one who sees everything as spatial, figurative, and shaped, whose soul is musical—forms appear through unconscious vibrations. He sees sounds, movement etc. within himself, whose soul is spatial—because the multitude of sounds and movements emerge through figuration.»

(NOVALIS, Fragments I, 1957: 314)

◂ ▴ Figure 160, 161 – Pomegranate Garden, S. Taschvighi-Bauer.



"The arabesques, patterns, ornaments, etc. are the actual, visible music." (NOVALIS, Fragments I, 1957: 314)

Figure 162 – Arabic characters (from KHATIBI/SIJELMASSI 1995).

«Longing to become sound and unite with the heavenly song.»

(Friedrich HÖLDERLIN, Hyperion: 479)

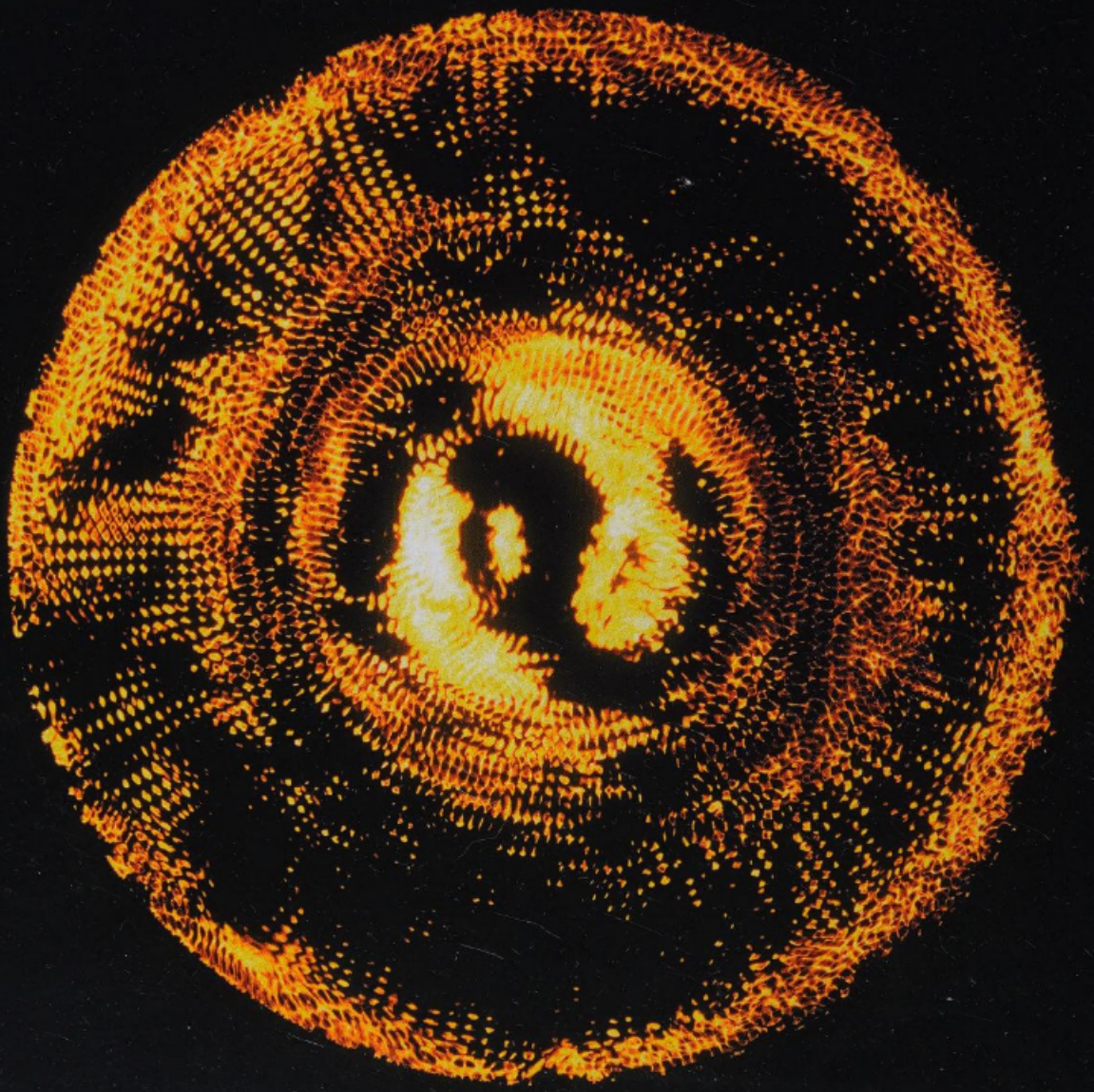


Figure 163 – Luciano Pavarotti.

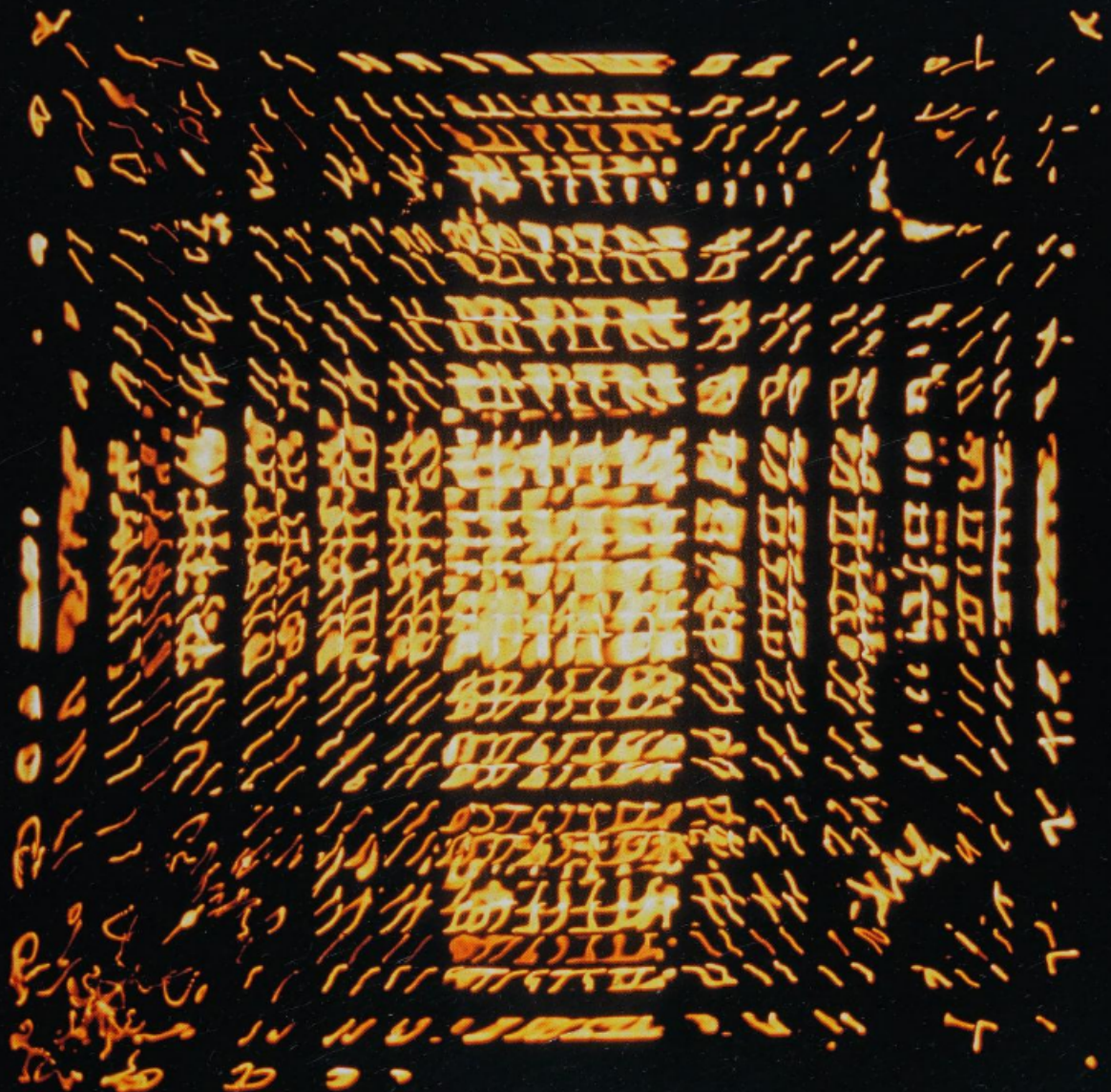
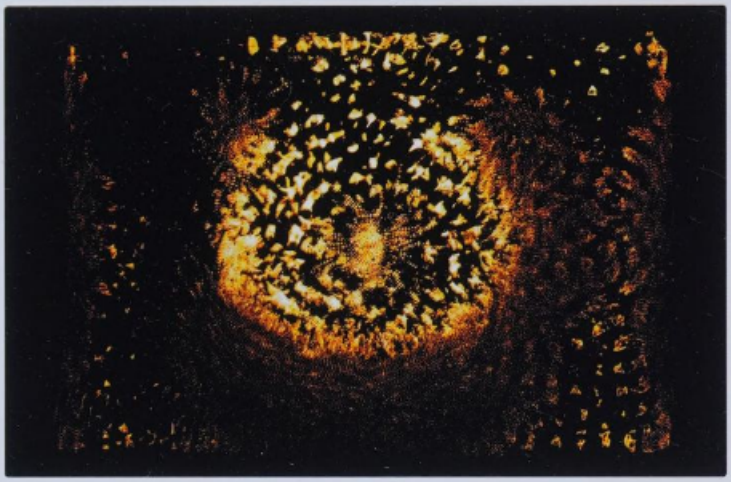


Figure 164 – Saxophone, Jan Garbarek.



◂ ▸ Figure 165, 166 – Saxophone, Jan Garbarek.

«We have seen that in the poem, the art of playing the *aulos* [ancient greek instrument] is described as the musical representation of wailing. Painful, human screaming has given rise to *aulos*-music according to this description. The *aulos* is a wind instrument. The sound of a wind instrument has great similarity to the voice. It is created, as is the voice, through breath, exhaled air. But the voice, when it is not the carrier of speech, directly conveys the dynamics of emotion. The scream is audible life. Through the voice one can, without speaking, express joy or pain. Thus the voice expresses the feelings of the subject, the feeling of joy and of pain, and it does that through the breath. And exactly this, the wind instrument does too.... But this music, the play of the *aulos*, is not the expression of the emotion, but rather it's artistic presentation. The goddess Athena was so deeply moved by the wailing of Medusa's sister, Euryale, that she could not help but hold her. She had the urge to give this impression a solid, objective form. This overwhelming, heart-wrenching impression of suffering, expressing itself through this wailing, was portrayed through, or better as, the *aulos*-song. The wailing was transformed into art, into skill, into *aulos*-play, into music. Athena essentially wove this song from the themes of wailing.»

(GEORGIADES, Music and rhythm of the Greeks, 1958: 21f.)

For Midas Of Akragas, Winner In The Flute-playing Match

Pray thee, lover of splendor, most beautiful among the cities of men, haunt of Persephone, thou who by the banks of Akragas' stream that nourisheth thy flocks, inhabitest a citadel built so majestically—O queen, graciously and with the goodwill of gods and men, welcome this crown that has come forth from Pytho for Midas' fair renown; and him too welcome therewithal, who hath overcome all Hellas in the art which, once-upon-a-time, Pallas Athene devised, when she created music from the fierce Gorgon's death-lament.

That heard she, pouring from the maiden's heads and heads of serpents, unapproachable amidst the anguish of their pain, when Perseus had stricken the third sister, and to the isle Seriphos and its folk, bore thence their doom.

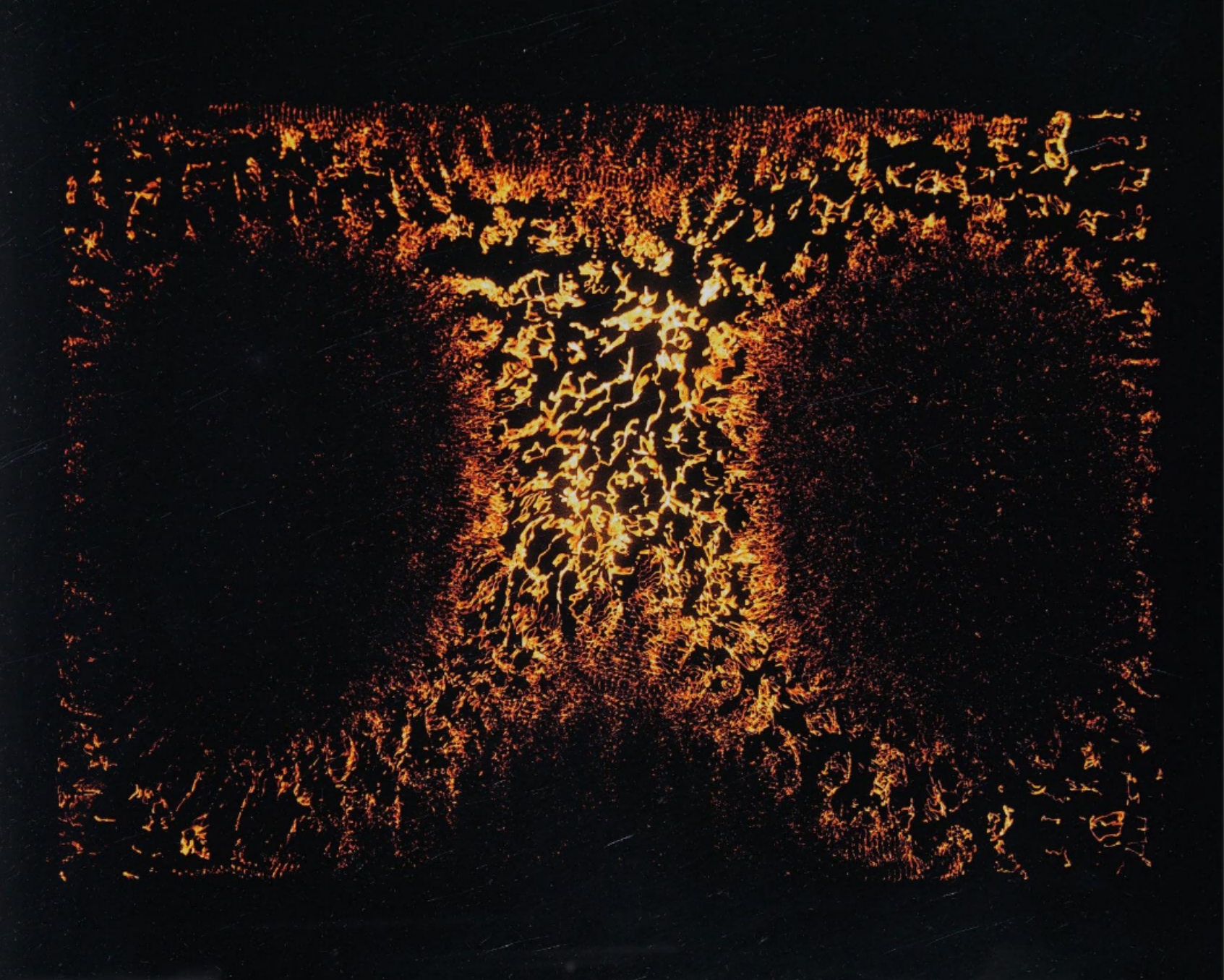
Yea also he struck with blindness the wondrous brood of Phorkos, and to Polydektes' bridal brought a grievous gift, and grievous eternally he made for that man his mother's slavery and ravished bed. For this he won the fair-faced Medusa's head, he who was the son of Danae, and sprung, they say, from a living stream of gold.

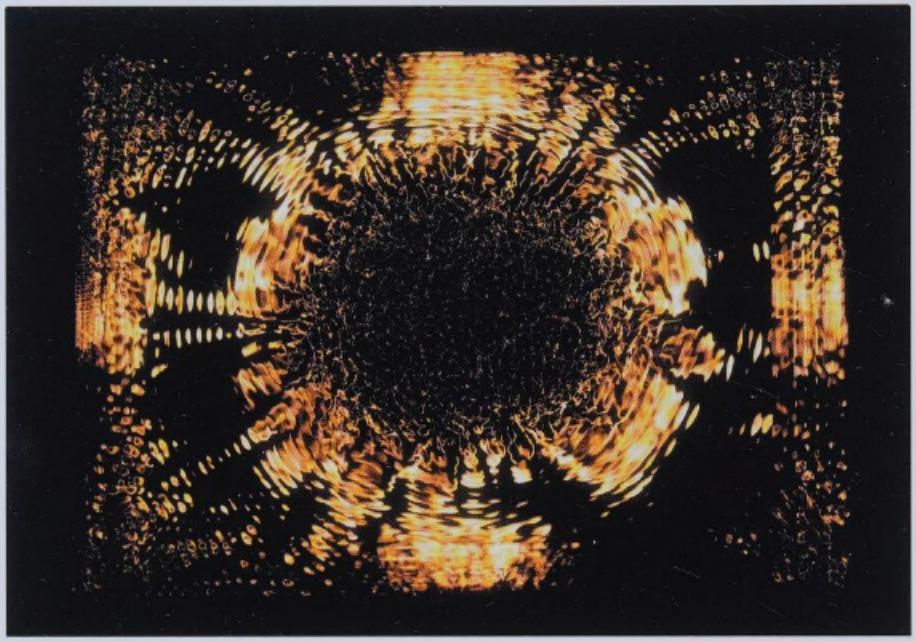
But the Maiden, once she had delivered her well-beloved from these toils, contrived the manifold music of the flute, that with such instrument she might repeat the shrill lament that reached her from Euryale's ravenous jaws.

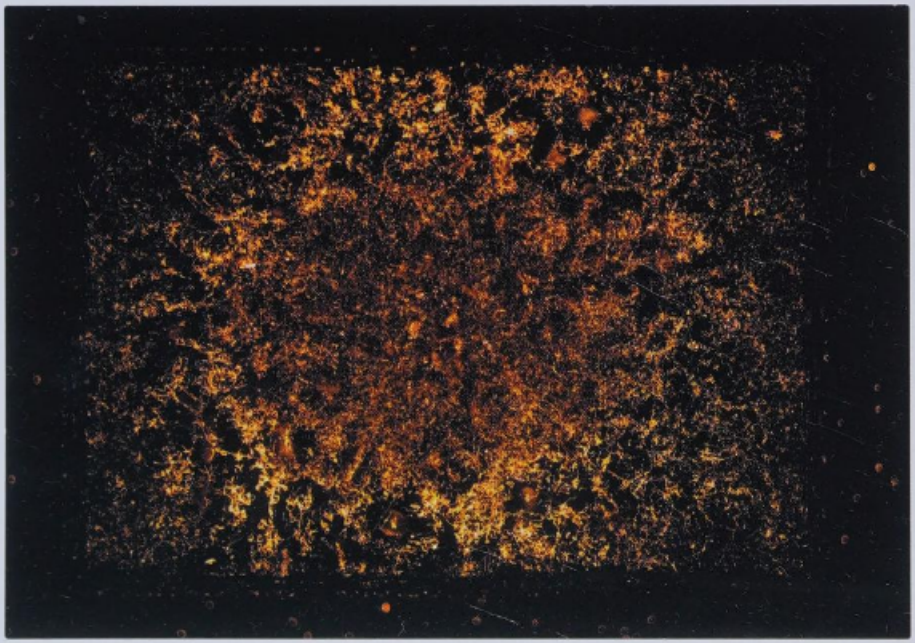
A goddess was the deviser thereof, but having created it as a possession of mortal men, she named that air she played 'the many-headed air,' that speaketh gloriously of folk-stirring games, as it issueth through the thin-beat bronze and the reeds which grow by the Graces' city of the goodly dancing-ground, in the precinct of Kephisos' nymph, the dancers' faithful witnesses.

But if there be any bliss among mortal men, without labor it is not made manifest. It may be that God will accomplish it even today, yet a thing ordained is unavoidable. Yea, there shall be a time that shall lay hold on a man unaware, and shall give him one thing beyond his hope, but another it shall bestow not yet.

(Ode of Pindar [c. 522 B.C–438 B.C.], Translated by Ernest Myers)







«Bring To Me The Sunflower

Bring to me the sunflower so that I may
plant it in my desiccated soil,
parched by sea spray's salty breath.
May her anxious, yellow visage
hang there all the day,
against the glistening blue mirror of heaven.

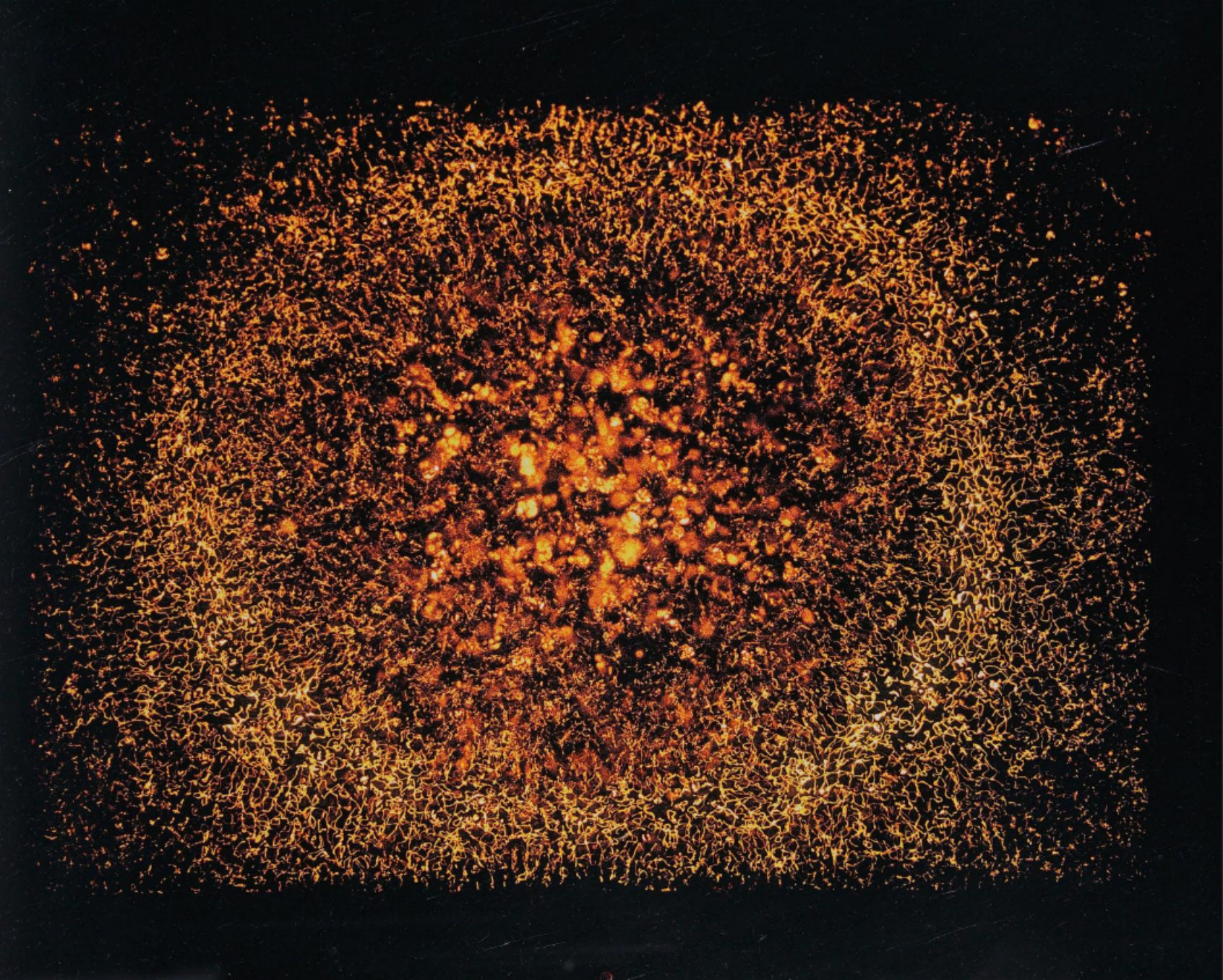
Into the light, unseen things are urging,
color-sounds surging out of bodies
consumed in the churning sea of music.
Is not to fade away
the consummation of all beauty?

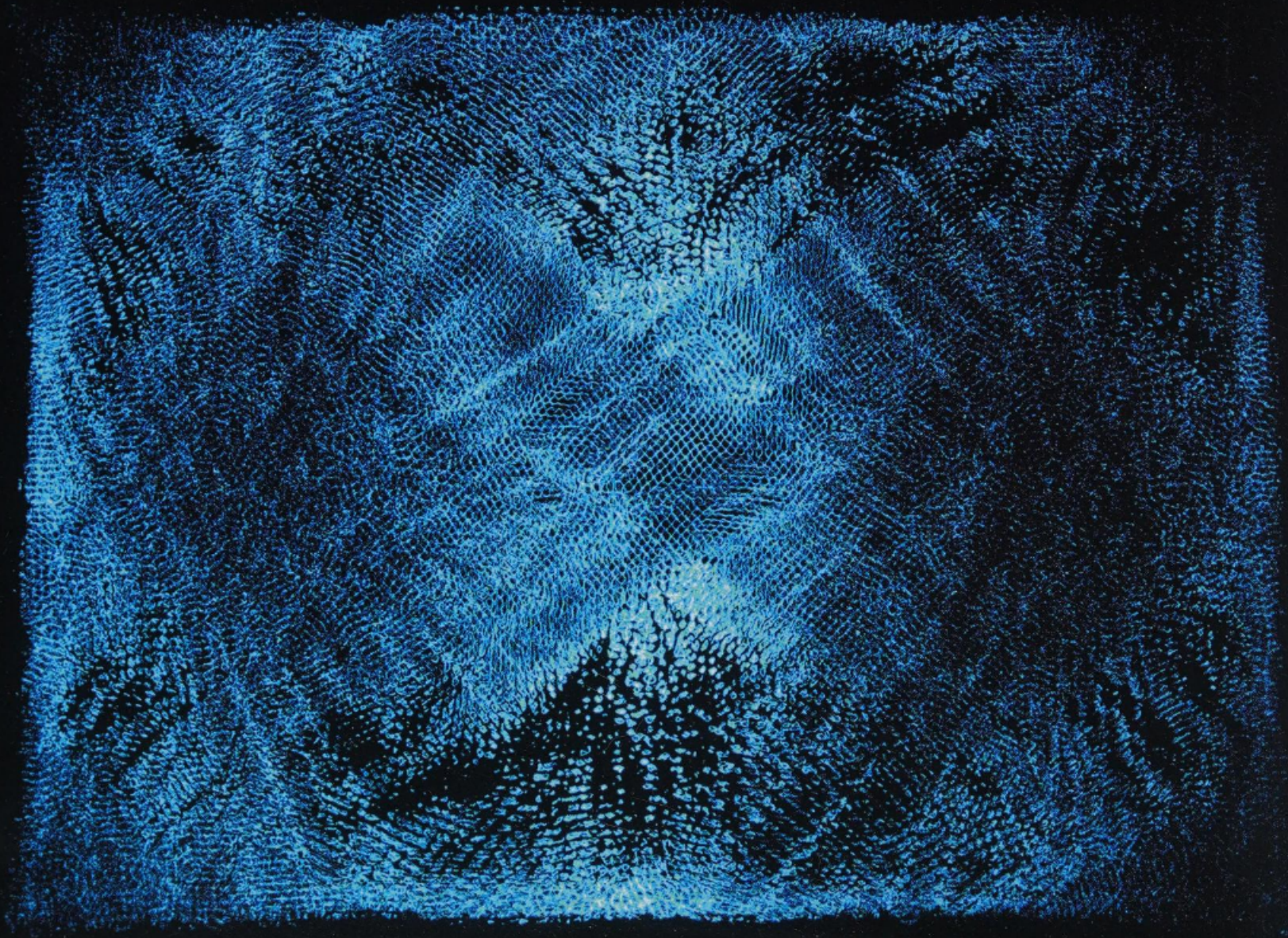
Bring to me the flower
which peers right at that spot
where transparent depths surge up
and life evaporates like ghostly essence;
bring to me the sunflower mad with light.»

(Eugenio MONTALE, quoted by SCHNIEPER, 1968: 26 [Translated from the German by Gunter M. Zielke and liberally re-interpreted by Jeff Volk])

◂ ▸ Figure 167, 168, 169

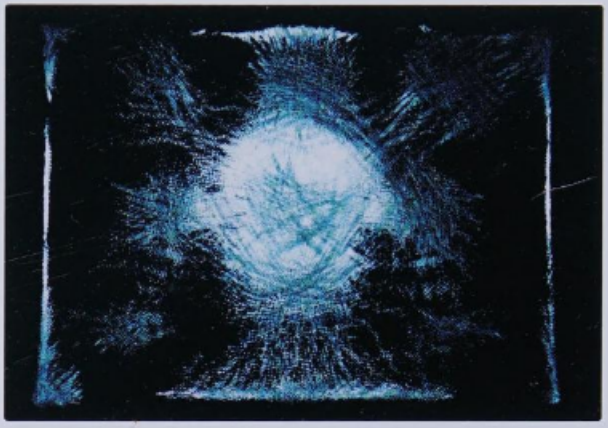
Poème de l'Extase, Alexander Skrijabin. [Piano Concerto]

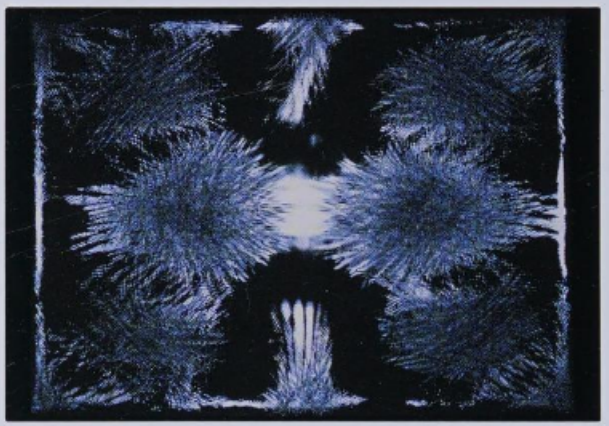


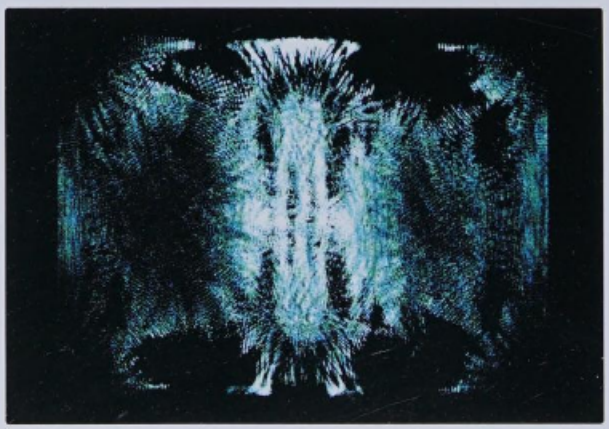


«But above all, I perceive in me with joy, a new tone, sounded by a violin within my innermost being. Its strings are tensed or relaxed through simple differences of temperature and illumination from without. Yet from deep within our being (an instrument that the conformity of habit has condemned to silence), there appears a song—out of those derivations, out of those vibrations—from which all music arises. The weather, on specific days, leads us perchance from one sound to another. We rediscover the lost melody, which—as we might have guessed—appears with mathematical necessity, and which we, without knowing it, sang from the first moment on. Only these inner modifications—inner, despite the fact that they came from the outside—renew the outer world for me.»

(PROUST, In Search of Lost Time, quote by SCHAVERNOCH, 1981: 182)





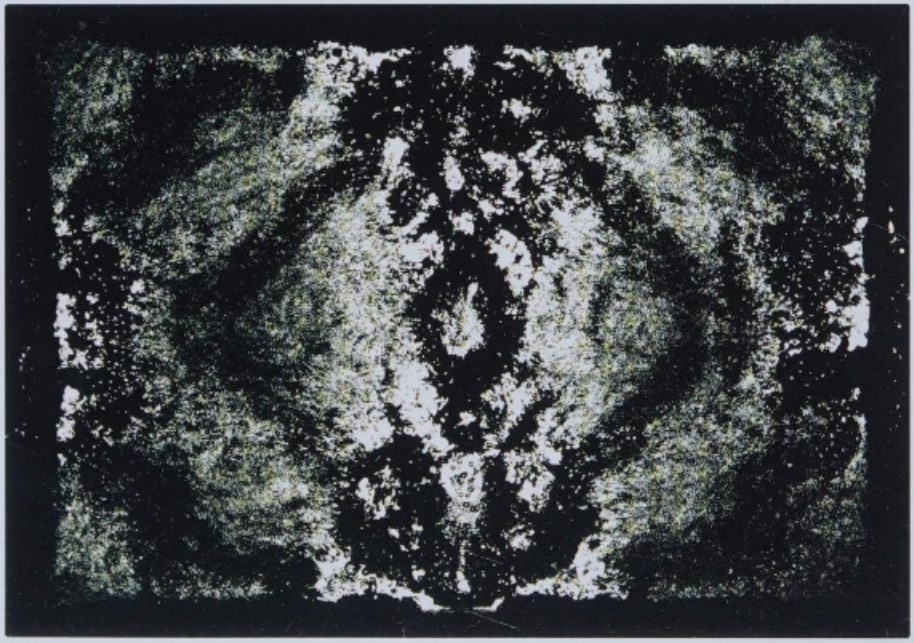


◂ ▸ Figure 170, 171 – *Pli selon pli*, Pierre Boulez.

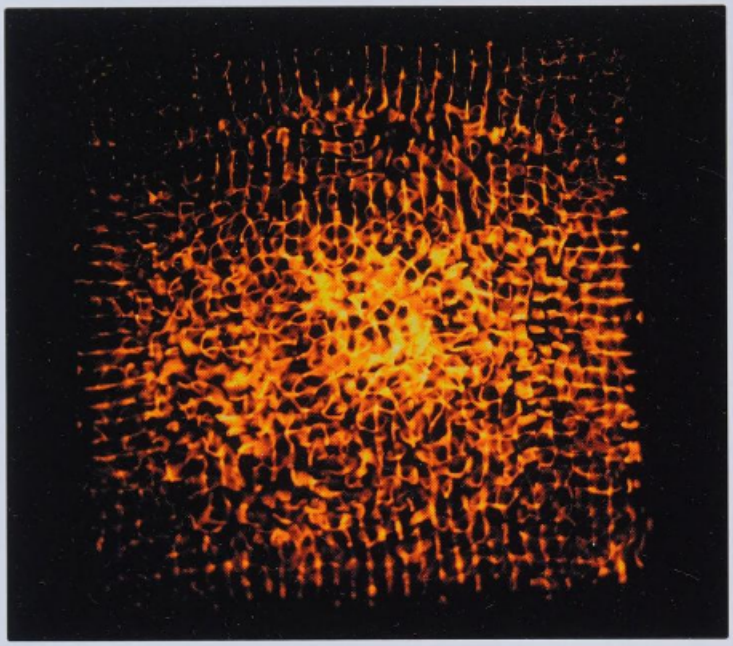
[Translator's Note: 'Fold by fold' is a piece of classical music by the French composer Pierre Boulez for solo soprano and orchestra. It is based on the poems of Stéphane Mallarmé. At over an hour, it is Boulez' longest work.]

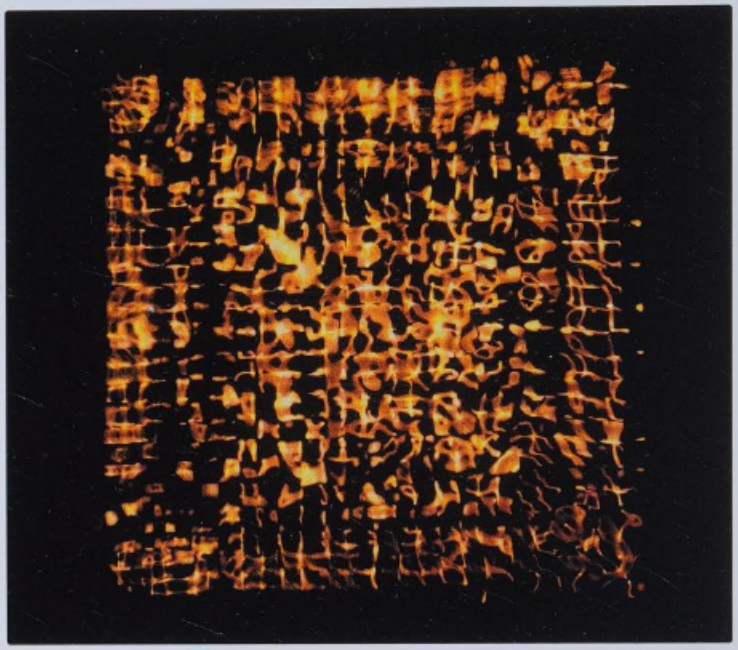
Man must have an ability that is outside and beyond the world. Otherwise how could he, unique in all creation, trace back the long path of evolution from the present to the deepest night of the past; how could he alone, rise to the beginning of all time, if there were not within him something from before the beginning of time? Emerging from the fountain of all things and being like it, the human soul shares an innate knowledge of creation. In it there lies the highest clarity of all things.... But this outer-worldly principle is no longer free in its primal purity; it is bound to another, lower, principle. This other principle is one that has become, and is therefore by its nature, unaware and dark; and necessarily darkens the higher one to which it is connected. In the soul, rests the memory of all things, their original relationships, their becoming, their meaning. But this first picture of all things sleeps in the soul as a dimmed and forgotten, yet not fully extinguished, image. It might never awaken if not for an inkling and longing of awareness hidden in the darkness."

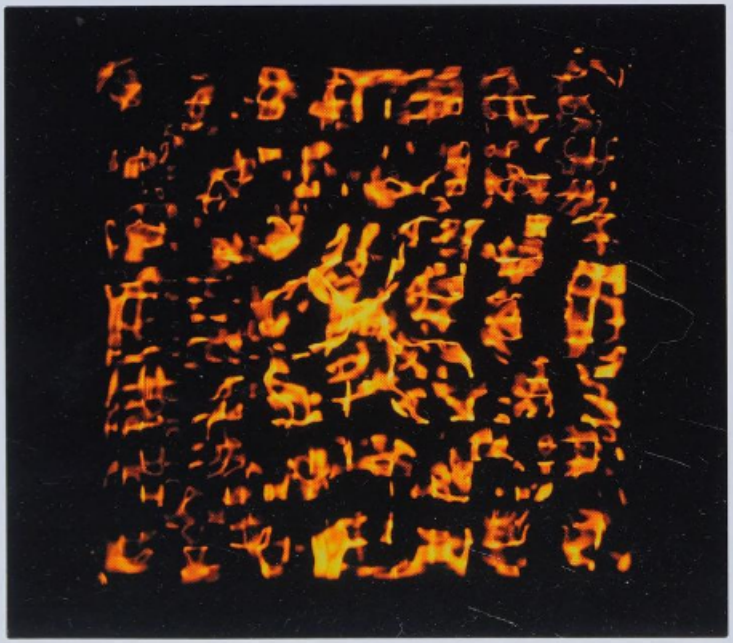
(F.W.J. SCHELLING, Ages of the World, 1985,4: 216)

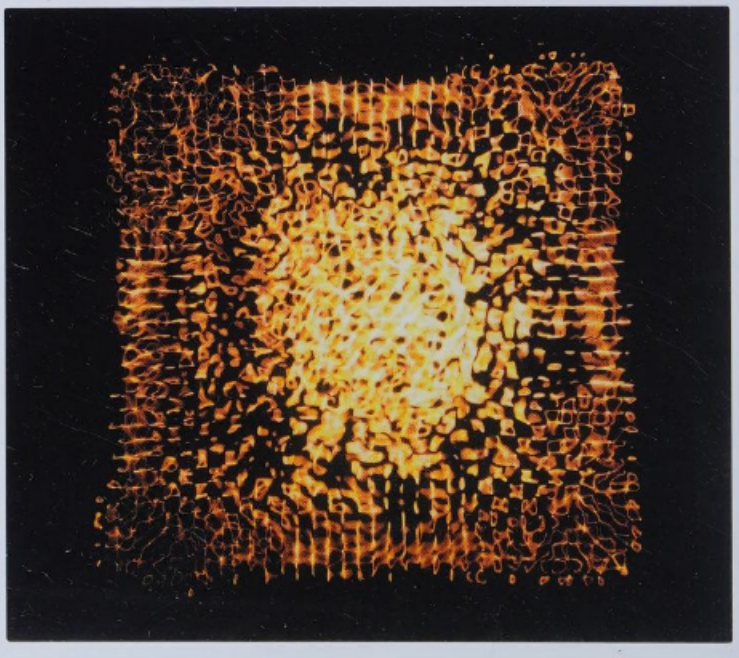


◂ ▸ Figure 172, 173 – *Dialogue de l'ombre double*, Pierre Boulez





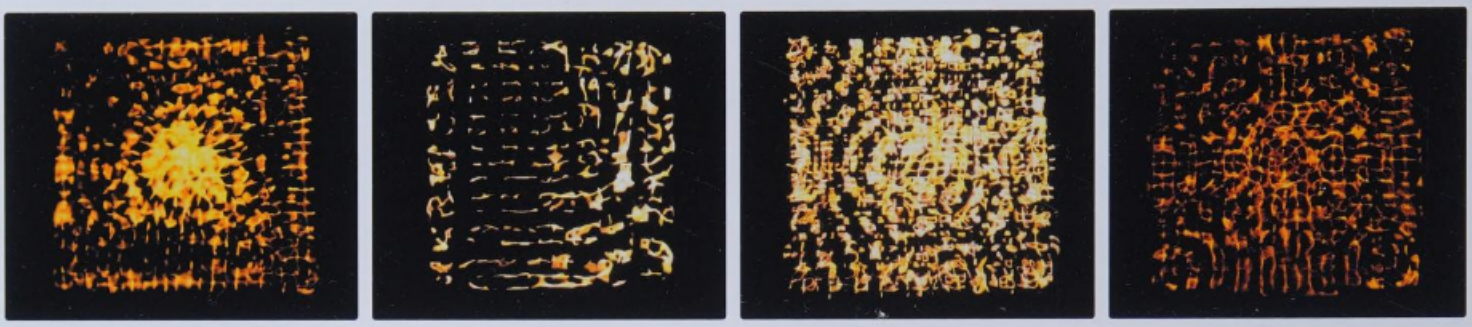




«He did not ask if we understood, nor did we question it. If his intention was that we really listen to it, then we absolutely shared that view. In light of what had been said, he continued, one has to view the work of which he spoke in particular, the Sonata, Op. 111. And then he sat down at the piano and played the whole composition by heart, the first and the tremendous second movement, while constantly commenting on his playing in order to guide our attention to the voice leading. Intermittently he sang along, demonstrating, full of enthusiasm—all this creating a somewhat comic and, judging by the reaction in the small auditorium, an occasionally hilarious spectacle. As he had a very strong key stroke and really piled it on in his *forte*, he had to yell very loudly to make his comments halfway understood, and to sing with great effort to vocally underline what he demonstrated. With his mouth he imitated what his hands played. 'Bam, bam—wham, wham—zang, zang' he shouted, during the fiercely vexed starting accents of the first movement and, in a high falsetto, he accompanied the passages of melodic mellifluence, of which the whirling thundersky of the piece is occasionally pierced like a tender ray of hope. Finally he put his hands in his lap, resting a moment and said: 'Now it comes.' He started the variation on the movement, the *Adagio Semplice e Cantabile*.

The arietta-theme, destined for adventure and fortune for which it does not seem to be born at all in its idyllic innocence, then comes up right away and plays out in sixteen bars, reducible to just one theme, that emerges at the end of its first half, like a short, soulful call—three notes only, one eighth, one sixteenth and one 32nd note, chanted no differently than 'heavens-blue,' or 'love-sickness,' or 'fare-thee-well,' or 'once-there-was,' or 'meadow-grounds'—and that is all. What—from this tender expression, this melancholic, quiet formation—arises subsequently in rhythm, harmony and contra-point, with which its master blesses it, and to which he condemns it, into which nights and glaring days, crystal spheres where cold and heat, rest and ecstasy are one and the same, he throws them into and arises them from, one might call sweeping, or strange, foreign and excessively grand, but without really naming it—as it is by its nature nameless. And all the while, Kretzschmar plays for us with laborious hands these enormous metamorphoses, as he sings along most ferociously: 'Dim, duh-duh,' he hollers: 'the tremolo chain! The coloratura and cadence! Do you hear the sustained convention? There—is—the language—not cleaned by the phrase—but the phrase—from the appearance—of its subjective—dominance—the appearance—the art is shed—at last—the art always sheds—the appearance of art. Dim—duhduh! Please listen, how here—the melody is overpowered—by the weight of the fugue chords! She becomes static, becomes monotone—twice, 'D,' three times following each other—the chords do it—dim-duhduh! Please pay attention now what happens here .'

It was extremely difficult to listen to his yelling and to the highly complex music at the same time, but we all tried—straining, bent forward, hands between our knees, looking alternately at his hands and his mouth. The character of this movement is the wide spread of bass and descant, of right and left hand, and there is a time, a most extreme situation, where the poor theme appears to float in a chasm alone and lost—an event of pale grandeur, followed quickly by a fearful shrinking, a worried fright about the fact that something like this could happen. But there is still a lot to happen before the end. Yet as the end approaches, and upon reaching it's



conclusion, something of a tenderness and goodness, totally unexpected and moving, happens—this after so much rage, persistence, keenness and eccentricity. The theme has gained so much experience, but now it takes its leave, and in so doing, transforms itself totally into a farewell, a waving good-bye. A slight change happens to this 'D-G-G;' it experiences a small melodic expansion. After an initial note 'C,' it picks up a 'C'-sharp from the D so that the chant is now no longer 'heavens blue,' or 'meadow grounds' but instead 'oh you heavens blue,' 'oh my meadow grounds,' 'live—here always true;' and this joining 'C'-sharp is the most moving, most comforting, melancholic reconciling act of the world. It is like a grievous loving stroke of the hair, of the cheek, a calm deep look into the eye for the last time. It blesses the object, the terribly treated formation—with an overwhelming humanization, warmly suggesting to the listener a good-bye, a final good-bye, so that his eyes will overflow. 'Now forget thy pain!' it says. 'Grand was—God in us.' 'All—was just a dream.' 'Think well—of me.' Then it breaks off. Fast, hard triplets rush to a random finale, which could have ended most any piece of music.

After all this, Kretzschmar does not return to the lectern from the piano. He remains, facing us, sitting in his swivel chair, in the same posture as we—bent forward, hands between the knees—and thus he finished, with a few words, his lecture about why Beethoven did not write a third movement for Opus 111. We only needed to hear the piece, he said, to answer the question for ourselves. A third movement? A new beginning—after this farewell? A coming back—after this separation? Impossible! It has happened, that the Sonata in its second movement, this immense one, has led itself to its end, to the end, never to return. And when he said: 'the Sonata,' he did not only mean this specific one, but the sonata as such, as an entire class, as a traditional art form. In this work, it has itself been led to the end, its fate fulfilled, its goal reached, beyond this, there is nothing more. It lifts and dissolves, it says good-bye—the waving farewell of the 'D-G-G' theme comforted melodically by the 'C'-sharp, a farewell to its kind, a farewell as big as the piece itself, the farewell of the sonata.»
(Thomas MANN, Doctor Faustus, 1975: 56ff)

▲ Figure 175 a–d – Piano Sonata, Op. 111, Ludwig van Beethoven.

Figure 176 – Toccata for Organ, F-Major, Johann Sebastian Bach.

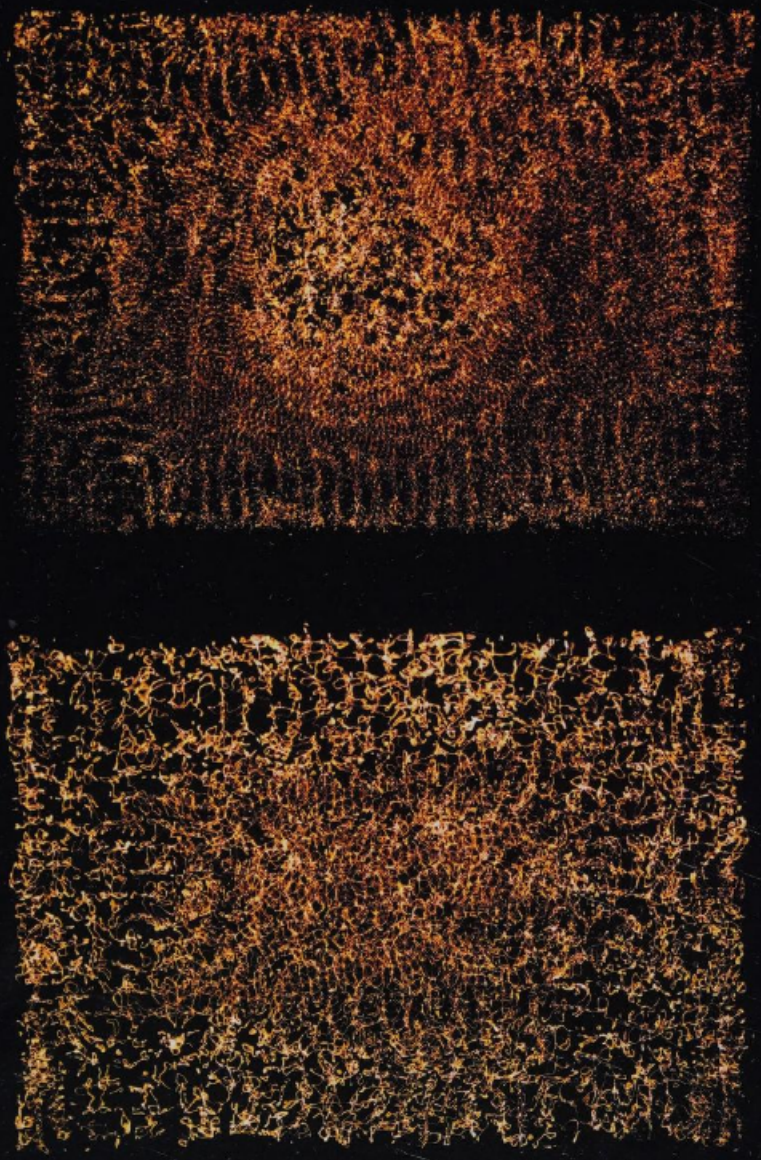


Figure 177 a–b – Toccata for Organ, F-Major, Johann Sebastian Bach

«Organplay

Sighing through vaults, sounds echo booming,
Organplay. Prayerful believers listen,
How multi-voiced in intertwined choruses,
Longing, mourning, angelic joy sounding,
Music constructing itself into spiritual spaces,
Swaying, lost in blessed dreams,
Building firmaments from sounding stars,
Their golden spheres dancing in circles,
Courting each other, closing and retracting,
Spiraling further and further, traveling sunward,
Until it seems, the whole world is illuminated,
A crystal, in its lucid net
Hundredfold, all in accord with God's purest laws
Illuminated spirit condensing itself.

That sheets full of notes
Become such widely arching, spirited gleaming,
Such worldly and heavenly choirs,
That an organ-pipe choir bewitches them.
Is it not a miracle beyond compare
That a musician at the manual
Embraces them with only man's force?
That a body of listeners understands,

Swaying in harmony, sounding, resplendent,
Wafting with them into the sounding universe? ...

He is not bothered that the congregation,
Pupils, masters, believers and friends
Are lost, that the youth—in a hurry—
Does not know the laws any more, the figures
The fabric, the senses unable to feel.
That for them, the notes no longer are
Memories of paradise and marks of God,
That not ten, not even one is able
To reconstruct these tone-vault's holy arches
In their mind and to give sense to this
Weaving of these long acquired mysteries.
And feverish all around in town and country,
Young life in its stormy path.
Yet in the temple, solitary in the pews,
Rules on, this ghostly ancient,
(half sage, half fool, to the young),
Spinning ordained memories,
Fills with divine sense all ornaments,
Moves registers of ever lower sounds,
Orders the fugue steps into the sacrament,
Only its ears still able to apprehend,
While others feel no more than whispering
Of the past and a quiet rustling
Of fragile flows of curtains, which, in the dark
Stony crypt of columns, wearily bulge.

Nobody knows, if still the old master
Plays inside, if the ethereal, quiet
Weavings of sound, circling in space,
Are only the haunting of left-over ghosts,
Echoes and phantoms from other times.
But sometimes a person pauses, listening,
At the cathedral, gently opening the portal,
Lost in reverie, heeding the distant silver stream
Of music, gathering from spirit's mouth—
Joyous-serene words of father's wisdom—
And leaves with a heart touched by sound,
Seeks the friend, giving a whispered account
Of the experience of the engrossed hour
There in the cathedral with the smell of extinguished candles.
And so continues to flow, in underground darkness,
Eternally the holy stream, sometimes
From the depth its notes sparkle;
One who is able to hear them, feels the power of their secret,
Sees it fleeing, wishing to hold it,
Burning with longing. Foreboding such beauty.»

(Hermann HESSE, Poems, 1977:647ff)

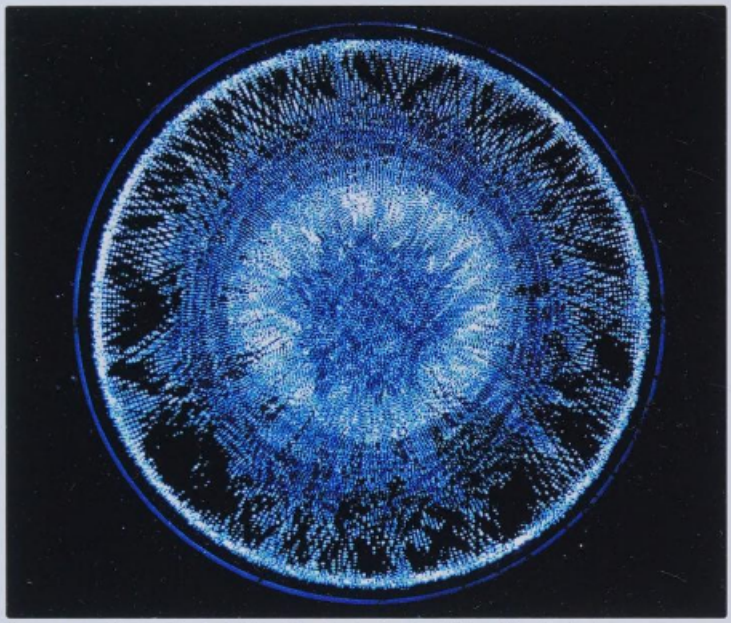


Figure 178 – Water-Music, Michael Kiedaisch, Eberhard Hahn, Mike Svoboda.

«In the beginning it was like a rustling, like the wind one hears from afar in the leaves of a tree. But then the roaring became mightier until it was like a waterfall or the thunder of the surf on a rocky shore.

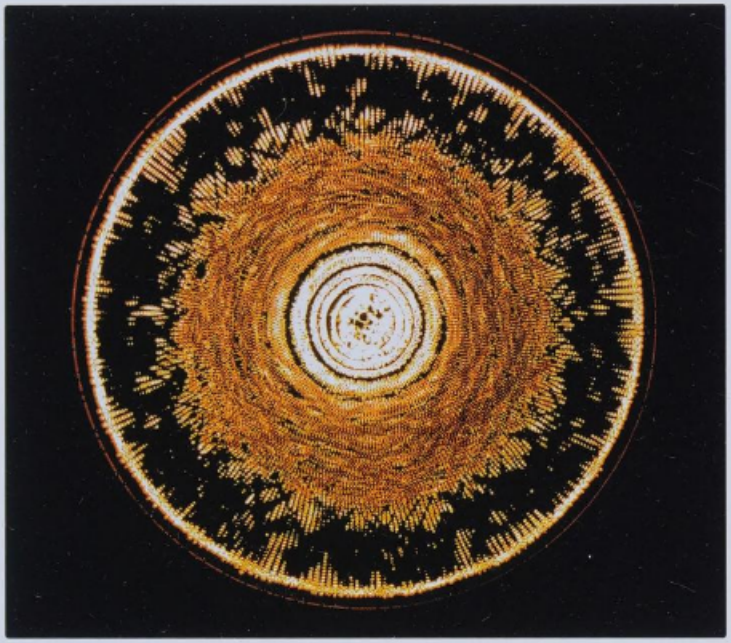
And Momo became more and more aware that this roar consisted of innumerable sounds that reordered themselves constantly, changing—always building new harmonies. It was music and something totally different at the same time. And suddenly Momo recognized it: It was the music that she had sometimes heard, quietly and from afar, when they had listened to the silence under the open sky. But now the sound became clearer and more brilliant. Momo felt that it was this sounding light that created and formed each of the blossoms in each unique and unrepeatable form, from the depth of the dark water. The longer she listened, the clearer could she distinguish their separate voices. They were not human voices, rather it sounded as if gold and silver and all the other metals sang. And then other voices of a very different kind emerged as if from behind, voices from unimaginable distances and of indescribable might. They became ever clearer, so that Momo now started to hear words, words of a language she had never heard before—but still understood. It was sun and moon and the planets and all the stars, revealing their true names. And in those names it was decided what each would do and how they would all work together to allow every single blossom of the hour to arise and pass on again. And all of the sudden, Momo understood that all those words were addressed to her! The whole world, right up to the most distant stars, was turned towards her as a single incredible immense face that looked and talked just to her!»

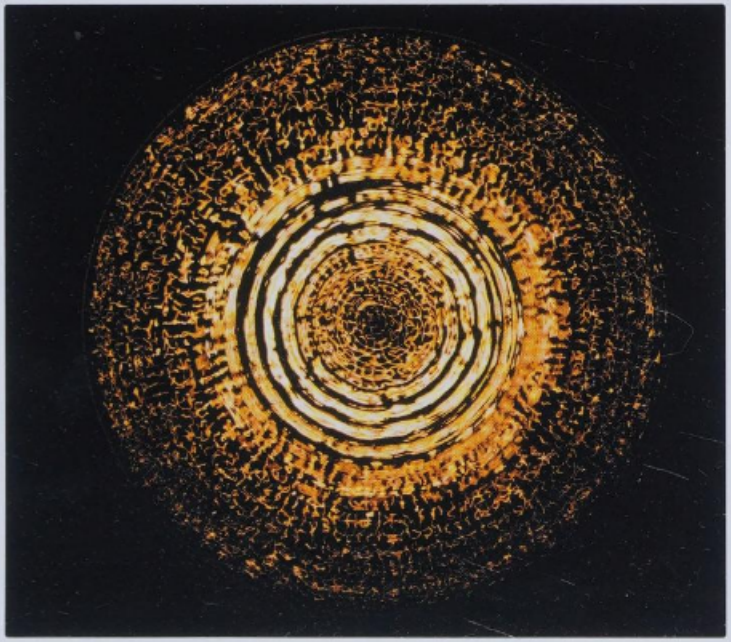
(Michael ENDE, Momo, 1973: 164)

«Golden Sound
O you sound of gold, drifting away,
of gold, entering all eternity.
How sad for our ear, to listen
to this gold, arriving in eternity;
This silence, losing its gold,
as it enters into eternity.»

(Juan Ramón Jiménez,
quote by Schnieper, 1968: 59)

Figure 179 – Sitar, Ravi Shankar.





◂ ▴ Figure 180 a–c – Sitar, Ravi Shankar.

« ... to the glorious secret spirit of the world ...»

(Friedrich Hölderlin, Hyperion: 485)

Epilogue

Beginning with my early fascination with the patterns of design of the turtle shell, I have, for many years, been intensely interested in shapes, forms, and patterns in nature. My first encounter with Chladni sound figures triggered something like an experience of resonance and I felt that the key to a deeper understanding of the process of 'taking shape' lay hidden in these phenomena.

Stimulated by the writings of Hans Jenny, I started to experiment myself—initially with Chladni sound figures, and later using water as the resonating medium. Thanks to the cooperation and ingenuity of Helmut Lua of 'Lua HIFI Manufaktur' (Frickingen, Bodensee, Germany), it became possible to develop a method of transmitting a wide range of frequencies directly into the metal plates and water containers. For these experiments, a radically new type of sound transducer had to be developed. My greatest gratitude goes to Mr. Lua.

This book [originally published in German in 2002, ed.] was intended to document and summarize the scope of my work with vibrations and sounds at that time. The approach here was two-fold; First, to present my own experiments offering a comprehensive overview of the investigated phenomena. On the other hand I continued to strive for a mental clarity of my own activities in the context of other opinions, views and theoretical approaches. Despite the objective, and essentially methodological approach of these experiments, my guiding light has always been an open and enquiring attitude, which unfolds through innocent amazement and the sensation of being profoundly touched, deep inside.

The main subjects I will focus on in the time ahead are: deepening our understanding of the different types of Chladni sound figures as well as the patterns of "standing waves;" intense study of the sound figures created by the human voice and their unique structures; the investigation of, under which conditions and through which vibrations or sounds, the 'golden mean ratio' leads to the manifestation of sound figures; the study of intervals and the forms and patterns emanating from them; research into less tangible effects on the development of water sound figures, as for example atmospheric influence (air pressure, electrostatic charge, etc.), positions and phases of the moon, different times of the day or year, the effect of the state of mind of the experimenter; and the question of the "memory" of the water.

My special thanks go to Urs Hunziker and Monika Schmidhofer of 'AT Verlag' for their offer to make this book a reality, and for publishing the original German edition. I also want to thank all those who helped to create and complete it, especially my committed editors Klemens Pasoldt, Martina S. and Michael Leusch, Lydia Keßler for patiently writing clean copy, Anna Lauterwasser for her assistance overcoming computer problems, "Fotogeschäft Lauterwasser" for preparing the vast number of images, and finally, "Photo Wauer" for digitizing these photos.

Alexander Lauterwasser, January 2002

Resources

Compiled by Brian Eckert, Eco-Restore/Eco-Restorative Institute.

Organizations Exploring the Vital Nature of Water

The Institute for Flow Science/Wolfram Schwenk
Stutzhofweg 11, D-79737 Herrischried, Germany
Tel. +49 (0)7764 9333 0 Fax 9333 22

http://www.stroemungsinstitut.de/

Founded by author and water researcher Theodor Schwenk, who developed the method of 'drop photography' to demonstrate differences of water's purity and energetic quality. Now administered by his son Wolfram Schwenk.

Hagalis AG
Goldbacherstrasse. 8
88662 Überlingen, Germany

www.hagalis.com

Most scientifically valid work on water crystals.

PKS Pythagoras Kepler School
Schauberger Family Estate, houses Viktor & Walter Schauberger museum.

www.pks.or.at

Researchers and inventors of implosion and vortex technologies as it relates to water. Periodically offers seminars.

Institute for Eco-Technology/Malmo Group.

www.iet-community.org

Swedish Schauberger Group.

Association for Applied Implosion Research
Director, Klaus Rauber

www.implosion-ev.de

Publisher of Implosion Magazine. German Schauberger Group.

Flow Design Research Institute
Director, John Wilkes

www.virbelaflowforms.anth.org.uk

Inspired by Theodor Schwenk, Wilkes developed Flowforms, fountains that mimic the rhythmic pulsation and figure eight movement of water in its natural state.

Filmstream

www.filmstream.com.au

Web-streaming films on water. Premier research videos for the advancement in studies of environmental systems and the management of water resources. Filmstream's water videos look at a wide range of research projects in Australia and overseas.

The Water Research Institute of Blue Hill

www.waterresearch.org

Education and research for a new consciousness regarding water. Works in conjunction with The Institute of Flow Sciences.

Wasser Symposium

www.wasser-symposium.ch

A comprehensive site with numerous insights and information on water. To view their English language site, search for Wasser Symposium. The premier conference focusing on water. Takes place bi-annually in Europe.

Alick Bartholomew

www.schauberger-books.org.uk

Original publisher of Schauberger Books. Serves as U.K. center for Schauberger information

Eco-Restore/Eco-Restorative Institute
Brian Eckert, Founder

www.eco-restore.com

Educates and promotes the understanding of water as a living substance. Eckert has researched Living Water and Living Water Systems for 12 years.

Further Reading on the Vital Nature of Water

***Water, the Element of Life* by Theodor Schwenk** (Recently reprinted)

The living movement of water makes life on earth possible. Based on Rudolf Steiner's Anthroposophy and their own numerous experiments, Theodore and Wolfram Schwenk show that the earth is a living organism and that water is its sense organ. Water perceives vital cosmic forces and influences and transforms these into earthly life.

***Flowforms, the Rhythmic Power of Water* by John Wilkes**

This book comprises over 40 years of research into flowform technologies and the natural movement of water. Lavishly illustrated to show both the beauty of the flowform and its wide range of applications, *Flowforms* details water's rhythmic dance, and the importance of these oscillations to water's vitality and the vitality of the life-forms it nourishes. A must-have for water researchers, engineers and those building new water-delivery systems!

***Water Crystals* by Andreas Schulz**

The quality of our water—especially drinking water—is becoming an increasingly important issue. Andreas Schulz uses a groundbreaking photographic process to make the quality of various kinds of water instantly visible to the non-specialist. Using water samples from many parts of the world, this remarkable and beautiful book provides a unique insight into the nature of water— its structures and its life cycles.

Understanding Water
by Andreas Wilkens, Michael Jacobi and Wolfram Schwenk

People throughout the ages have experienced—consciously or otherwise—the life-giving and healing forces of water. It is integral to life, though water can carry both beneficial or harmful energies. The authors of this stunningly illustrated book are scientists at the Institute for Flow Sciences. They offer a unique view into the world of water, helping us better understand one of the most essential elements of our earthly life.

***The Healing Energies of Water* by Charlie Ryrie**

Tracing the development of human relationships with water, from primitive healing cults to the most recent scientific studies, this thoughtful volume explores water's role in our spirituality, folklore and myth.

***Sensitive Chaos* by Theodor Schwenk**

"Water is more than a mere flow of energy or a useful means of transport." Lavishly illustrated, *Sensitive Chaos* shows the unifying forces which underlie all living things. The book illuminates the flow phenomena, from birds' flight to movements of fish and air patterns in musical instruments. It observes the formation of internal organs, mountain ranges and river deltas, sand patterns on the beach and even the human embryo.

***Hidden Nature* by Alick Bartholomew**

This book is the most recent distillation of Schauberger's work from the original English language publisher. Accessible and relevant, it shows how his ground-breaking work can effectively deal with today's environmental crisis.

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and finally...

when you have completely exhausted yourself
pursuing the light,

allow your mind to rest
and listen
deeply

to the gentle melodies
resounding
eternally
within your heart of soul.

JV

"I had fewer difficulties discovering the motions of the heavenly bodies, despite [illegible] investigating the motion of flowing water, which takes place right before our ey[illegible]

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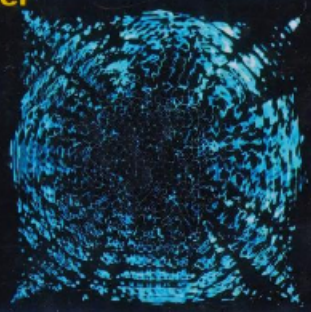
Water

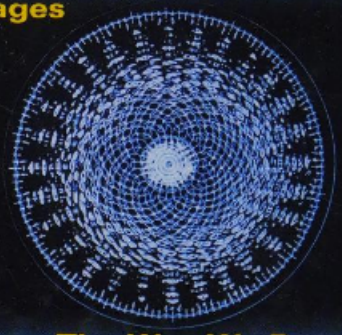


Essence of Life

Sound

The Creative Impulse

Images



The Way We Perceive

These three 'elements' are perhaps the most omnipresent, yet least understood influences on earth! Many of the world's creation myths describe the formation of the primordial universe as a liquid state which gradually condenses under the influence of sound...the firmament manifesting the Word of God, *Nada Brahma*, the world is sound...a world sung into being. Through our contemporary, scientific lens, we now conceive of all form as resonance fields—structure, as sound coalescing into matter.

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